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(Registered as a Newspaper.)

FRIDAY,
JANUARY 27, 1905.

PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

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These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.

See our Advertisement appearing February 17th, page 45.

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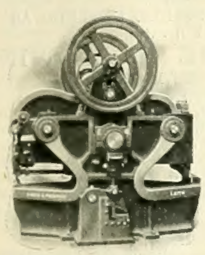

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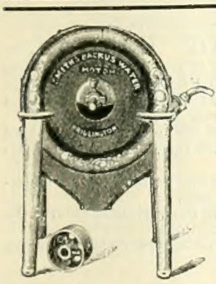

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Backus Water Motors

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Will drive any class of Machinery, and work on 15 lb. pressure.

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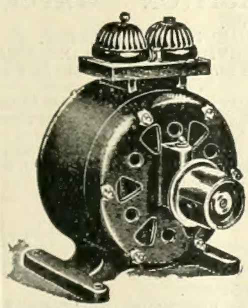

Alternating Current Motors,

IN SMALL SIZES.

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Telephone No. 12830 Central.

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Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

28, NEW BRIDGE STREET, LONDON, E.C.,
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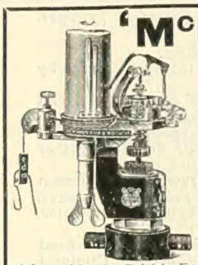

'McINNES-DOBBIE' INDICATORS.

In Two types: External and Enclosed Pressure Springs.

Each made in several forms and sizes to suit all speeds and pressures.

Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

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Adopted by the British, French and Japanese Admiralties.

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PAGE'S WEEKLY Contracts

CONTRACTS.

THE URBAN DISTRICT COUNCIL OF HANDSWORTH.

POWER AND LIGHTING CIRCUITS, PIPEWORK, &c., AND ELECTRICITY METERS.

The Urban District Council of Handsworth invite TENDERS for the SUPPLY and DELIVERY of the following in connection with the Electric Lighting Undertaking :—

CONTRACT No. 10.—POWER and LIGHTING CIRCUITS and FITTINGS in Generating Station.

CONTRACT No. 11.—PIPEWORK, FEED PUMPS, ECONOMISER, &c.

CONTRACT No. 12.—ELECTRICITY METERS.

Tenders will only be considered for the whole of the work covered by each specification, and not for any part thereof.

Copies of the specification, with the conditions of contract, &c., can be obtained on or after Thursday, the 12th January, 1905, from the undersigned on payment of Three Guineas for each specification, which amount will be returned on receipt of a *bonâ fide* Tender, together with the specifications, drawings, conditions of contract, &c.

The specifications, conditions of contract, and drawings can be seen at (but not obtained from) the offices of the Consulting Engineers, Messrs. KENNEDY AND JENKIN, 17, Victoria Street, Westminster, London, S.W.

Tenders on the prescribed form, in sealed envelopes, and endorsed on the outside "Electric Light and Power Supply, Tender, Contract No. —," must be delivered at my office at the Council House, Handsworth, before noon on Thursday, February 2nd, 1905.

The Tender of any person or firm paying less than the standard rate of wages current in the district in which the work is executed will not be considered.

The Council do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of any Tender.

H. WARD, Clerk.

The Council House,
Handsworth, near Birmingham,
January 10th, 1905.

COUNTY BOROUGH OF WEST HAM.

TENDERS FOR SUPPLIES, &c.

The Council hereby invite Tenders for the supply of Engine-Room Stores, Cable, Integrating Wattmeters, Double-Pole House Cut-Out Boxes, Transformers, Incandescent Lamps, Coal.

Forms of Tender and further particulars may be obtained after the 26th inst., at the Borough Electrical Engineer's Office, Central Electricity Station, Tucker Street, Canning Town, upon the payment of £1 for each form of Tender, which will be returned upon receipt of a *bonâ fide* Tender.

Tenders to be enclosed in endorsed envelopes supplied with the forms, and sent to my office not later than 4 o'clock on Thursday, February 9th, 1905.

The Tenders will be opened at the Town Hall, West Ham, on Friday, February 10th, 1905, at 3 p.m., and persons tendering may be present if they so desire, but no guarantee is given that any information, beyond the names of persons tendering, will be read out.

The Council do not bind themselves to accept the lowest or any tender. The contractor will be required to enter into a bond with sureties for the due performance of the contract, and no goods, materials, &c., will be ordered under any contract until such bond has been duly executed.

The contractor whose Tender is accepted, and with whom a contract is entered into, will be required to pay to the whole of his workmen such rates of wages, and observe such hours of labour, as are recognised by the workmen's trade unions, and in force at the time of signing the contract. In the event of any breach of such agreement the Council will enforce the penalty clause in its entirety.

By order of the Council
FRED E. HILLEARY,
Town Clerk.

Town Hall, West Ham, E.,
January 21st, 1905.

TO ROAD BRIDGE CONTRACTORS.

THE RURAL DISTRICT COUNCIL OF

Chertsey, in the County of Surrey, invite TENDERS for the CONSTRUCTION of the TWO BRIDGES known as the Plough Bridges across the River Wey, on the road from Weybridge to Byfleet.

Plans can be seen and copies of the specification obtained on deposit of a postal order of £1 (which will be returned on receipt of a *bonâ fide* tender) at the offices of Mr. R. ST. GEORGE-MOORE, M.Inst.C.E., 17, Victoria Street, Westminster, S.W., the Engineer.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders to be endorsed "Tender for Bridges," and addressed to the Chairman of the Council, to be delivered at the Council Offices, No. 80, Guildford Street, Chertsey, before Twelve o'clock noon on Monday, the 30th January, 1905.

By order,
H. E. PAINE,
Clerk to the Council.

Chertsey, January 4th, 1905.

BURY AND DISTRICT WATERWORKS.

TO CONTRACTORS.

PIPE LINE FROM GIN HALL RESERVOIR TO WHITEFIELD, CONTRACT No 2.

The BURY and DISTRICT JOINT WATER BOARD invite TENDERS for CUTTING and REFILLING TRACK and LAYING and JOINTING 10,500 lineal yards of 12-in. diameter CAST-IRON from Gin Hall Reservoir, near Bury, to Whitefield, and other relative works.

Plans may be seen and copies of the Specification and Bill of Quantities and Form of Tender obtained at the Bury Office of the Engineer to the Board, Mr. J. CARTWRIGHT, Civil Engineer, Peel Chambers, Bury, on and after the 20th instant, upon payment of £1. This sum of deposit will, after the Board shall have come to a decision upon the Tenders, but not before, be returned to the Tenderers, provided they shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same, and shall have returned all documents furnished to them for the purpose of making up their Tender.

Tenders, enclosed in the official envelopes provided, must be delivered at the Office of the Subscriber not later than Saturday, the 18th February next.

JOHN HASLAM,
Clerk to the Board.

Bank Street, Bury,
January 16th, 1905.

TO PIPE FOUNDERS.

THE DIRECTORS OF THE SHEFFIELD UNITED GAS LIGHT COMPANY invite

TENDERS FOR THE FOLLOWING

CAST-IRON SPIGOT and SOCKET PIPES, viz. :—

200 2-in. Pipes in 6 ft. lengths.
500 3-in. " " 9 ft. "
1500 4-in. " " 9 ft. "
200 6-in. " " 9 ft. "

The pipes must be cast vertically. The price to include delivery to Sheffield, which must be made in about two months from receipt of order. Tenders addressed to the undersigned, to be sent in not later than the first post on Friday, February 3rd, 1905. The Directors do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
January 13th, 1905.

COUNTY BOROUGH OF HALIFAX.—

The TRAMWAYS and ELECTRICITY COMMITTEE of the HALIFAX CORPORATION invite TENDERS for the SUPPLY and ERECTION of a COAL CONVEYOR, SHUTES, &c., in connection with their Electric Light and Tramway Power Works.

Plans and Specifications may be seen and Forms of Tender obtained on application to Mr. W. M. ROGERSON, A.M.Inst.E.E., Borough Electrical Engineer, Foundry Street, Halifax.

Tenders, endorsed "Coal Conveyor," must be sent to the undersigned on or before Tuesday, January 31st, 1905.

The person whose Tender is accepted will be required to observe the fair contracts clauses adopted by the Corporation.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

WIDNES CORPORATION WATER-WORKS.

TO BORING AND WELL-SINKING CONTRACTORS.

The Widnes Corporation invite TENDERS for SINKING TWO 32-in. BOREHOLES in the new red sandstone at their Stocks Well Pumping Station.

Copies of Specification and Plans may be had on application to the Engineer, Mr. ISAAC CARR, M.Inst.C.E., Widnes, on payment of Three Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Tenders, endorsed "Boring," must be addressed to the Chairman of the Gas and Water Committee, and delivered at the Town Hall, Widnes, on or before noon on Tuesday, February 7th, 1905.

By order,
H. S. OPPENHEIM,
Town Clerk.

Widnes, January 16th, 1905.

BOARD OF PUBLIC WORKS.—NOTICE TO CONTRACTORS.

Sealed TENDERS, addressed to the undersigned, will be received up to, but not later than, Ten o'clock a.m. on the 11th day of February, 1905, for EXECUTING certain WORKS at Downies Bay, County Donegal, viz. : An EXTENSION of the existing PIER, DREDGING, ROCK EXCAVATION, &c., according to the plans to be seen at the Coastguard Station, Mulroy, Larganreagh, Letterkenny, County Donegal, and at this Office, where the specification, schedule, form of contract, and printed form of Tender can be had.

The Board will not be bound to accept the lowest or any Tender.

By order,
H. WILLIAMS,
Secretary

Office of Public Works, Dublin,
December 22nd, 1904.

PAGE'S WEEKLY Contracts

STEEL ROAD BRIDGE.—The URBAN DISTRICT COUNCILS of ESHER and THE DITTONS and WALTON-ON-THAMES are prepared to receive TENDERS for the REMOVAL of an EXISTING CAST-IRON BRIDGE and the ERECTION of a STEEL BRIDGE over the River Mole at the boundary of the Urban Districts.

Plans and Specifications can be seen by appointment at the Offices of the Engineer, A. J. HENDERSON, Assoc.Mem.Inst.C.E., Council Offices, Portsmouth Road, Thames Ditton, Surrey.

Contractors tendering will be required to deposit a £5 Bank of England note, which will be returned on the receipt of a *bonâ fide* Tender and the return of any drawings or documents issued.

Sealed Tenders must be on the prescribed form, and delivered not later than Tuesday, the 31st inst.

The Urban Council do not bind themselves to accept the lowest or any Tender.

E. A. EVERETT, Clerk.

Council Offices, Portsmouth Road, Thames Ditton, Surrey.

COUNTY BOROUGH OF WARRINGTON. The Water Committee is prepared to receive TENDERS for the SUPPLY of the following MATERIALS for a period of 12 months from the 1st April next :—

Section No. 1.—Pipes, Castings, Valves, Hydrant Covers, &c.
Section No. 2.—Bib, Stop and Ball Cocks, Ferrules, &c.
Section No. 3.—Oils, Packings, &c,
Section No. 4.—Yarn, Washers, Tools, Carting, &c.

Specification and form of Tender may be obtained from the Water Engineer, Municipal Offices, Sankey Street, on payment of 10s. per section, which will be returned on receipt of a *bonâ fide* Tender.

The Contracrors whose Tenders are accepted will be required to observe the recognised customs and conditions as to rates of wages and working hours prevailing within the district.

Tenders, in securely fastened envelopes, endorsed "Tender for Material, Section No.——," and addressed to "The Chairman, Water Committee, Town Hall, Warrington," to be delivered not later than 10 a.m. on Saturday, February 11th, 1905.

The lowest or any Tender will not necessarily be accepted.

J. LYON WHITTLE, Town Clerk.

Town Hall, Warrington, January 20th, 1905.

COMMISSIONER FOR RAILWAYS' OFFICE, BRISBANE, NOVEMBER 16th, 1904.

2,000 TONS OF STEEL RAILS AND 168 TONS OF STEEL FISH-PLATES.

TENDERS WILL BE RECEIVED AT this office until 2 p.m. on Tuesday, the 7th March, 1905, endorsed "Tenders for Steel Rails and Fishplates," and accompanied by a preliminary deposit of 1 per cent. on the Tender.

Specification, &c. (price 10s. 6d. per copy), can be obtained at the office of the Chief Engineer, Brisbane, on and after the 16th day of November, 1904, and also at the office of the Agent-General for Queensland, 1, Victoria Street, London, on and after January 3rd, 1905.

The lowest or any Tender will not necessarily be accepted.

T. S. PRATTEN, Secretary.

APPOINTMENTS OPEN.

MARTELL SCHOLARSHIP IN NAVAL ARCHITECTURE. A SCHOLARSHIP of the annual value of £50, and subject to certain conditions, tenable for three years, will be OFFERED for COMPETITION by the Institntion of Naval Architects.

Candidates must not be less than 18 or more than 21 years of age on March 1st, 1905, and must at that date have been continuously employed for two years upon naval architecture or marine engineering.

Further particulars may be obtained from the SECRETARY of the Institution of Naval Architects, 5, Adelphi Terrace, London, W.C. (envelopes to be marked "Martell Scholarship").

Applications must be sent in by February 1st, 1905.

THE VICTORIA UNIVERSITY OF MANCHESTER. The Council desires to proceed to the APPOINTMENT of a PROFESSOR of ENGINEERING.

The Professor will be responsible for the organisation of the Engineering Department, and will have the direction of the Engineering Laboratory.

He may take a consulting practice under specified conditions.

His stipend will be composed of a fixed salary and a share of the fees, and the Council guarantee that the total income will not be less than £1,000 per annum during the first three years.

A detailed statement of the conditions of appointment may be obtained from the Registrar.

Applications, with references and such testimonials (not exceeding three in number) as the candidate may desire, should be sent on or before February 15th to the Registrar.

BOMBAY, BARODA, AND CENTRAL INDIA RAILWAY COMPANY.

ASSISTANT ELECTRICAL ENGINEER.

The Directors are prepared to receive APPLICATIONS (by letter only) from duly qualified candidates for APPOINTMENT as an ASSISTANT ELECTRICAL ENGINEER for the Carriage and Wagon Department.

Candidates should be about 25 years of age, must have had a good general and technical education, and possess a thoroughly practical up-to-date knowledge of direct and tri-phase dynamos, accumulators, and electric fittings, combined with workshop experience gained with an electrical firm of good standing.

Terms : A five years', agreement, with first-class free passage to India.

Salary, Rs. 400 per calendar month.

The Candidate selected will have to pass a medical examination by the Company's consulting physician before appointment.

Letters of application, accompanied by a brief record in chronological order of the candidate's career, with dates and copies (not originals) of testimonials, marked outside "Assistant Electrical Engineers," should be addressed to the undersigned not later than 31st inst.

T. W. WOOD, Secretary.

Offices, Gloucester House, Bishopsgate Street Without, London, E.C., January 9th, 1905.

BATTERSEA BOROUGH COUNCIL.

TO ELECTRICAL ENGINEERS.

The Council invite

APPLICATIONS FROM PERSONS NOT less than 28 years of age for the APPOINTMENT of ELECTRICAL ENGINEER, to take entire charge of the Electric Supply Department and the running of the Station. Applicants must have had experience in the working of a three-wire continuous-current system.

Commencing salary £400 per annum.

Forms of appilcation and particulars of duties may be obtained at the Town Hall, Lavender Hill, S.W., and must be delivered to me, duly filled up and accompanied by copies of not more than four recent testimonials, under cover, endorsed "Electrical Engineer," by Mid-day Tuesday, Januury 31st.

The person appointed will be required to reside within the Borough. Personal canvassing strictly prohibited.

W. MARCUS WILKINS, Town Clerk.

January 12th, 1905.

BOROUGH OF LYMINGTON.—The Town Council of the Borough of Lymington invite APPLICATIONS for the APPOINTMENT of a WORKING MANAGER in the Waterworks Department.

Candidates must be thoroughly experienced in the duties, and capable of working the Oil Engines at the Waterworks.

The duties include the inspection of water fittings, making connections, &c., in the Borough.

The officer appointed will be required to make night inspections.

The salary will be 30s. weekly. A house and garden is provided at the Waterworks, and the successful applicant will also be supplied with three tons of house coals during the year.

The appointment will be made at the monthly meeting of the Council to be held at the Town Hall, Lymington, on Thursday, the 9th day of February, 1905.

Applications, endorsed "Appointment of Working Manager at Waterworks" on the outside, stating age and present employment, accompanied by copies (which will not be returned) of recent testimonials as to character and competency, must be made in the candidate's own handwriting, and sent to me, the undersigned, before 3 o'clock p.m. on the 31st day of January, 1905.

The successful candidate will be required to give at least one month's notice in the event of his desiring to terminate his engagement at any time.

By order,

J. DAVIS RAWLINS, Town Clerk.

Town Clerk's Office, Lymington, Hants. January 13th, 1905.

CITY OF WORCESTER.—SEWAGE DISPOSAL WORKS. The Council invite APPLICATIONS for APPOINTMENT as RESIDENT ENGINEER and CLERK of the WORKS for the pumping and purification works of their sewage disposal scheme, to act under the direction of the Engineer.

Applicants must have experience in the construction of buildings and bacteria beds, and the erection of pumping machinery.

Salary, £4 4s. per week.

Applications, in candidate's own handwriting, with not more than two recent testimonials, to be sent to me on or before the 1st February.

SAMUEL SOUTHALL, Town Clerk.

Guildhall, Worcester, January 17th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Premier Electrolyte Co., 26, Spital Square, London, E.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Electric Lighting).
J. & H. McLaren, Midland Engine Works Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C,

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
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Matthews & Yates, Ltd., Swinton, Manchester.

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J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.
E. J. & J. Pearson, Ltd., Stourbridge.

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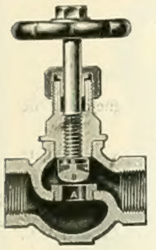

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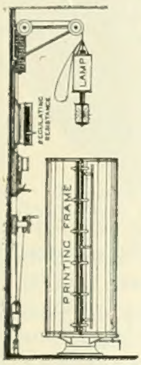

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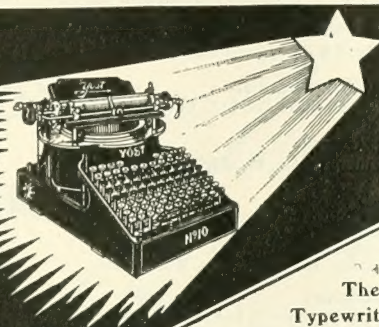

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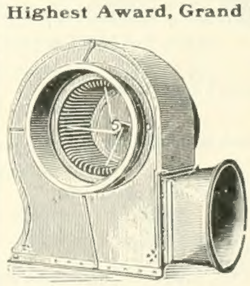

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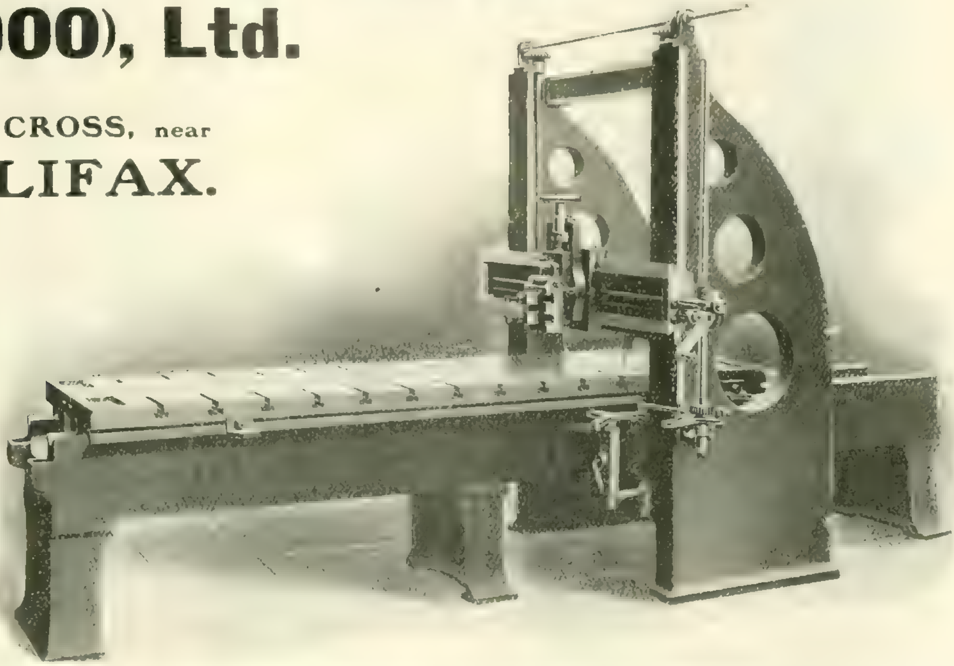

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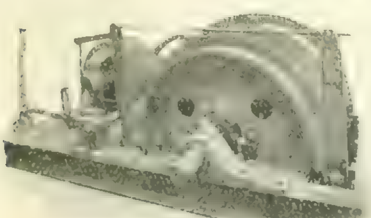

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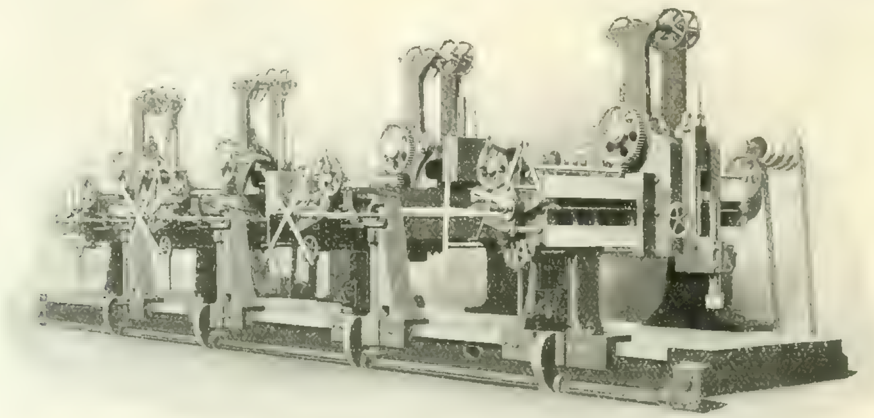

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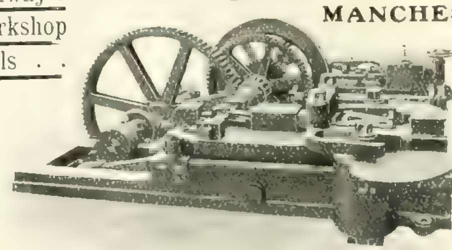

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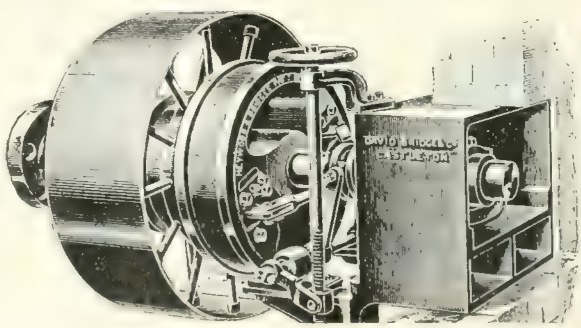

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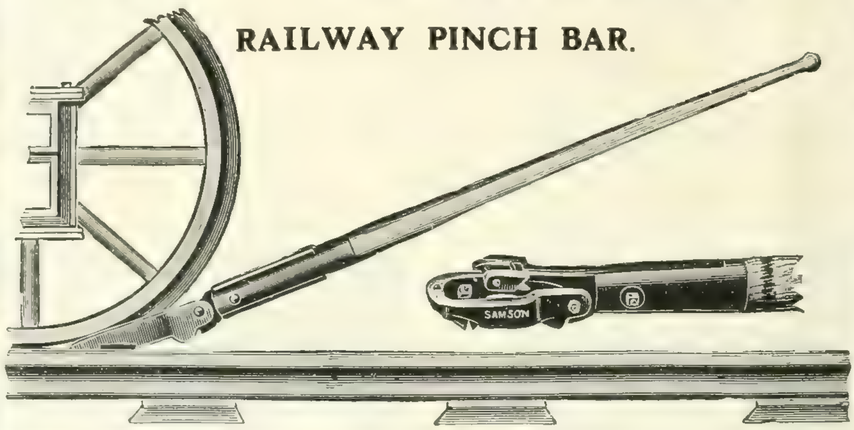

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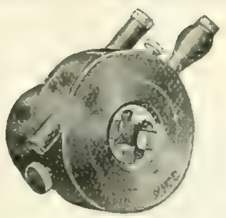

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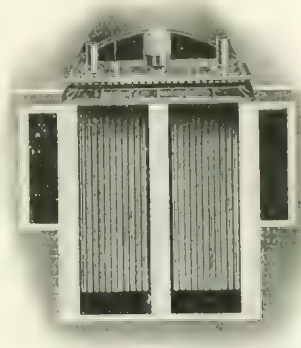

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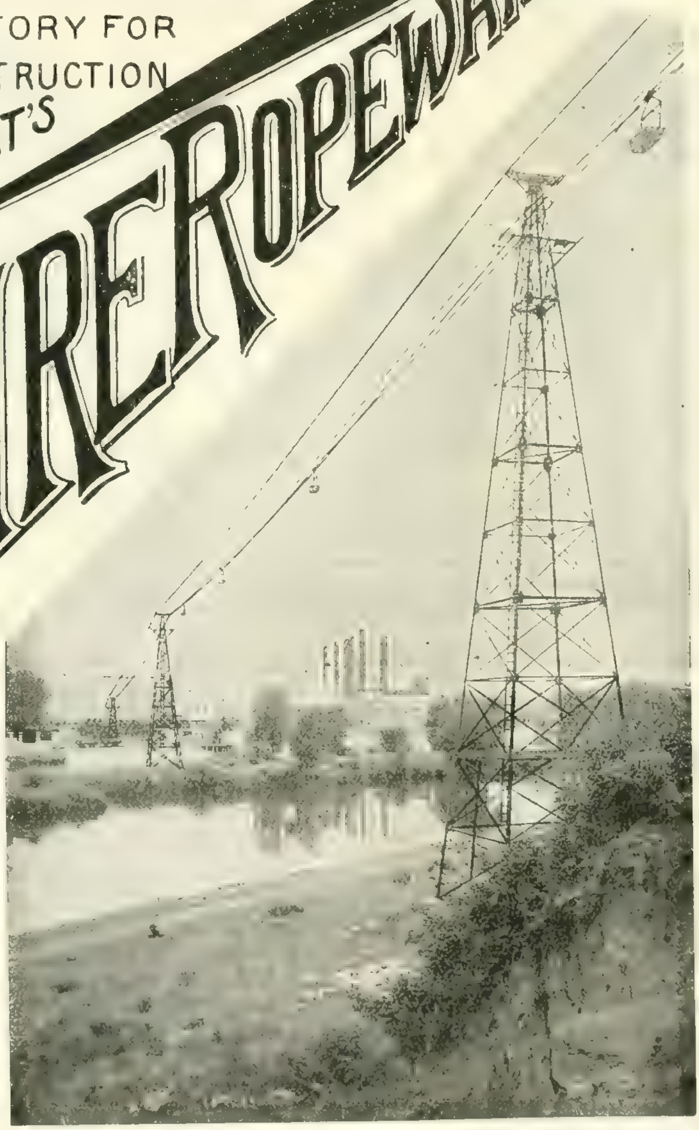

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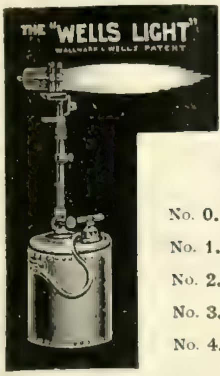

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No. 2.—1,500 or 2,000 Candles, useful and portable pattern	£15 10 0
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This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

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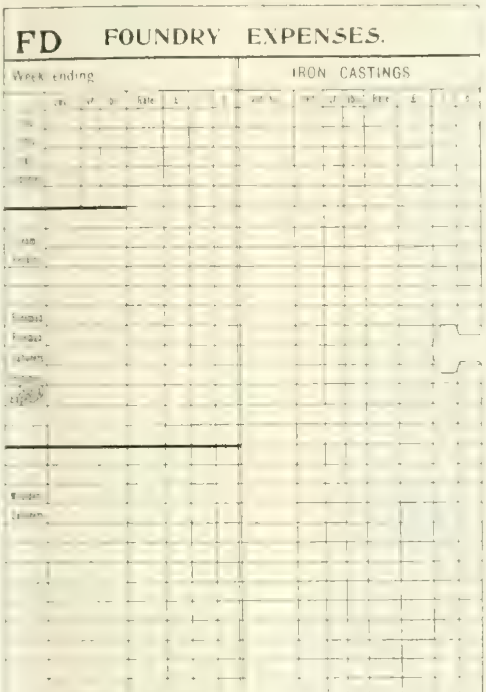
PAGE'S WEEKLY Miscellaneous

PAGE'S WEEKLY Systems for Engineers

THE COST OF PRODUCTION.


FD FOUNDRY EXPENSES.
Week ending
IRON CASTINGS

Accurate Factory costs are of the first necessity to Manufacturers. The fact that it is possible to follow through the entire process of manufacturing any article or number of articles, at different times, so that fluctuations can be noted, and showing in minutest detail the amount of material used, labour involved, special tools required, cost of packing, shipping, etc., and finally showing the actual cost of the completed articles, demonstrates the great value of the

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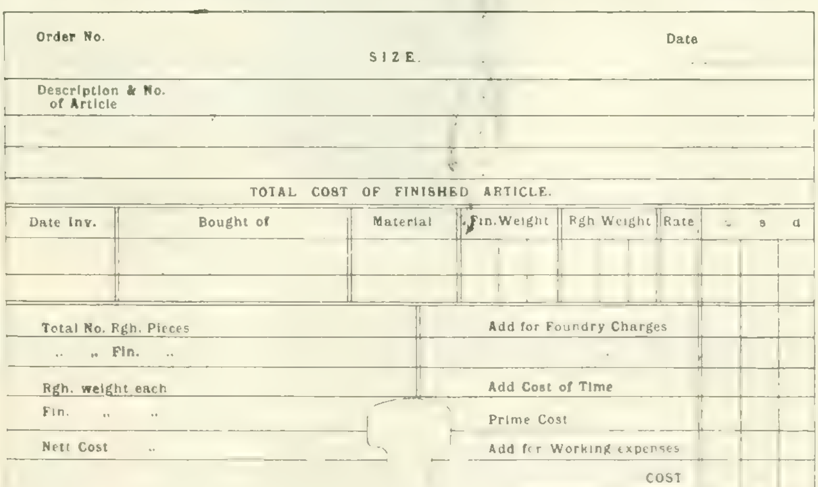
Order No. Date
SIZE.
Description & No. of Article
TOTAL COST OF FINISHED ARTICLE.

Date Inv.	Bought of	Material	Fin. Weight	Rgh. Weight	Rate	£	s	d

Total No. Rgh. Pieces — Add for Foundry Charges
„ „ Fin. „
Rgh. weight each — Add Cost of Time
Fin. „ „ — Prime Cost
Nett Cost „ — Add for Working expenses
COST

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Will Mr. Dales, of Hull, kindly send his address to the ROCKWELL-WABASH CO., Ltd.?

PAGE'S WEEKLY Systems for Engineers

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY Miscellaneous

Index to Advertisers—(Contd.)

PAGE'S WEEKLY Miscellaneous

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, JANUARY 27, 1905. No. 20.

The Offices of "Page's Weekly," Wednesday, Midnight.

THE autumn meeting of the Iron and Steel Institute, fixed as usual for the last week in September, will be anticipated with enthusiasm both by the inhabitants of Sheffield and by the English and foreign visitors to that city. The following gentlemen will form an executive committee for the visit: The Lord Mayor (Alderman J. Jonas), the Master Cutler (Mr. George Hall), Mr. R. A. Hadfield (President), Colonel Hughes, Mr. H. H. Bedford (President of the Chamber of Commerce), Mr. W. F. Beardshaw, Mr. W. H. Ellis, Mr. S. J. Robinson, Mr. F. C. Fairholme, Mr. R. Colver, Mr. Ambrose Firth, Mr. T. W. Ward, Mr. John Rodgers, Mr. H. Steel, jun., Mr. Charles Allen, Alderman G. Senior, Mr. Woodward (Edgar Allen and Co.), Mr. S. Osborn, Mr. A. Jack, Mr. T. Wilkinson, Mr. Cosmo John (Vickers, Sons, and Maxim), Mr. A. J. Hobson, Mr. E. S. Howell, Mr. A. Balfour, Mr. R. Smith, Colonel Stoddart (Mayor of Rotherham), Mr. Maurice Deacon, Mr. Potts (J. H. Andrew and Co.), Mr. B. G. Wood, Mr. C. Siddall, Mr. Herbert Barber, Mr. J. H. Barber (Brown, Bayley and Co.), Principal Hicks, Mr. H. Westlake (Staveley Iron Co.), Mr. Lewis Firth, and Mr. M. J. Hunter. It is hoped that the new University College buildings will be available for the meeting. In view of the presidency of Mr. R. A. Hadfield, Sheffield offers a particularly happy venue, and we shall look forward to a record meeting.

The following is a list of the autumn meetings of the Institute since its formation in 1869: 1869 Middlesbrough-on-Tees; 1870 Merthyr Tydvil; 1871 Dudley; 1872 Glasgow; 1873 Liége; 1874 Barrow-in-Furness; 1875 Manchester; 1876 Leeds; 1877 Newcastle-on-Tyne; 1878 Paris; 1879 Liverpool; 1880 Düsseldorf; 1881 London; 1882 Vienna; 1883 Middlesbrough-on-Tees; 1884 Chester; 1885 Glasgow;

MR. ALLISON SMITH.

Recently appointed under the Colonial Office Locomotive Superintendent of the Gold Coast Railway.

1886 London; 1887 Manchester; 1888 Edinburgh; 1889 Paris; 1890 New York; 1891 London; 1892 Liverpool; 1893 Darlington; 1894 Brussels; 1895 Birmingham; 1896 Bilbao; 1897 Cardiff; 1898 Stockholm; 1899 Manchester; 1900 Paris; 1901 Glasgow; 1902 Düsseldorf; 1903 Barrow-in-Furness; 1904 New York.

In the course of their annual report the council of the Leeds Chamber of Commerce state that they have for a long time past felt the importance of the development of the canal system of this country. That this is so much behind the systems of other countries is due partly to the larger navigable rivers possessed by other countries, for, whilst this country has some 4,500 miles of navigation, the United States has nearly 20,000, Germany some 16,000, Russia 20,000, and France 8,000, and all these countries are spending immense sums in the improvement of their canal systems. We are again reminded that, excluding navigable rivers and ship canals, there are some 4,000 miles of inland waterways in this country, of which about 30 per cent. are railway-owned, the remaining 70 per cent. being free from railway control. As showing the difference between these two classes of canals, it is mentioned that about 15 per cent. only, or an average of 5,000 tons per mile, pass over railway-controlled canals, whilst 85 per cent., or an average of 12,000 tons per mile, pass over free canals. But it is pointed out that the great defect of our canal system is the difference in gauge of locks and navigable depth between the different canals connected. One useful aim would be to suggest means for the amalgamation of the through waterways, and for carrying out works with the view of securing uniform gauge of locks and navigable depth. As an instance of what may be done in this direction, it is stated that a junction canal of some five and three-quarter miles in length has recently been made connecting the Aire and Calder Navigation with the Sheffield and South Yorkshire Navigation, and this short length has been made of such width and depth as to allow boats of the Aire and Calder type to pass thereover.

The Panama Canal is likely to be a very costly undertaking for the United States Government, and the time of its building will probably be equal to that of a generation, if present estimates are correct. Mr. J. F. Wallace, the chief engineer, of the Isthmian Canal Commission, has reported that a sea-level waterway across the isthmus, although it would cost far more and take much longer to complete than the three other canal projects under consideration, would in the end be the best. In his opinion, the cost of the sea-level canal would be $300,000,000, as against $200,000,000 for a 90-ft. level canal, and he thinks that twenty years would elapse before its completion, or ten years more than for a canal with locks.

Few readers, even if not directly interested in Patent regulations, can have perused the correspondence on this subject which has been appearing in the recent issues of Page's Weekly without arriving at the conclusion that further legislation is imperatively needed, if justice is to be done to the inherent inventiveness of the British as a nation. It is unnecessary to sum up the correspondence here, as this is ably done in the present and preceding issue by Mr. B. H. Thwaite. It is hoped that the opinions stated will be of material assistance to those who are called upon to strike a just balance between the claims of the inventor and those of the general public. Among the points brought out by the discussion is the superiority of American Patent regulations. The Americans from the beginning seem to have realised the extraordinary importance of sound Patent legislation.

The first United States Patent Law of April, 1790, only followed in a general way the law

at that time in existence in England, authorising the grant of patents without an examination of the prior art, and it is interesting to note the care with which those responsible for the granting of patents set about their duties. Mr. Jefferson, who was at that time Secretary of State, made the Patent Laws a subject of anxious solicitude, and regarded the granting of a patent as a matter of the greatest importance; in fact, he is generally referred to as the Father of the United States Patent Laws. When the application for a patent was made under the first Act, he would summon Mr. Henry Knox, of Massachusetts, who was Secretary of War, and Mr. Edmund Randolph, of Virginia, who was Attorney-General (these officers being designated by the Act, with the Secretary of State, a tribunal to examine and grant patents), and these three distinguished officials would examine the applications critically, scrutinise each point of the specification and claims carefully and rigorously. The result of this examination was that during the first year, a majority of the applications filed failed to pass the ordeal, and only three patents were granted. In those days every step in the issuance of a patent was taken with great caution, Mr. Jefferson seeking always to impress upon the minds of his officers and the public that the granting of a patent was a matter of no ordinary importance.

Captain Lionel James, although maintaining that the value and possibilities of wireless telegraphy in conjunction with journalistic enterprise has been amply demonstrated in the far East, is emphatically of opinion that all wireless communications during future military and naval operations will be controlled by international law. It will be remembered that the system employed on board the *Haimum* was that of Dr. de Forest, and it was chosen owing to its successful work in the field of American press rivalry during the yacht races of 1903. It is significant that within a radius of 200 miles of the scene of operations in the Yellow Sea, "countless" other wireless stations were at work on no less than four different systems. The fact that none of these other systems or stations interfered in the smallest degree with the Times messages did not fail to impress Captain James with the merits of the de Forest system. But how far his operations interfered with the other systems he is of course unable to say. The service was suspended, because the Japanese authorities recognised that the existence of the possible leakage of military secrets presented a flaw in their plan of campaign. Apart from this, a continuance of this enormously expensive service would have been fatal to the operators, for the Russians had threatened them with the death penalty and the Yellow Sea was literally alive with floating mines.

The new issue of Lloyd's Register states that during 1904, exclusive of warships, 712 vessels of 1,205,162 tons gross (viz., 613 steamers of 1,171,375 tons and 99 sailing vessels of 33,787 tons) have been launched in the United Kingdom. The warships launced at both Government and private yards, amount to 37 of 127,175 tons displacement. The total output of the United Kingdom for the year has, therefore been 749 vessels of 1,332,337 tons. This output of mercantile tonnage shows the slight increase of about 15,000 tons on that of last year, and, with the exception of 1903, is the lowest since 1897. Compared with the returns for 1901, when the output of both mercantile and war tonnage reached the highest level, the present figures show a reduction of 320,000 tons as regards merchant vessels, and 84,794 tons as regards war vessels. Of the tonnage launched 99·71 per cent. has been built of steel, ·17 per cent. of iron, and ·12 per cent. of wood. Steam tonnage is accountable for 97·2 per cent.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No. ... GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial. *All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

Any contributions offered, as likely to interest either home or foreign readers, dealing with the industries covered by the Weekly, should be accompanied by stamped and addressed envelope for the return of the MSS. if rejected. When payment is desired this fact should be stated, and the full name and address of the writer should appear on the MSS.

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

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When Foreign Subscriptions are sent by Post Office Orders, advice should be sent to the Publisher.

Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be received **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

NEWS ITEMS.

Royal Coal Commission.

As we go to press the Final Report of the Royal Commission on Coal Supplies (Part I., General Report) comes to hand. Following the precedent of the Coal Commission of 1871, the limit of practicable depth in working has been set at 4,000 ft. and the minimum workable thickness at 1 ft. The available quantity of coal in the proved coal fields of the United Kingdom is estimated at

100,914,668,167 tons.

Of the available coal, no less than 79·3 per cent. is contained in seams of 2 ft. thick, and upwards. In addition to the coal within 4,000 ft. of the surface there are in the proved coalfields considerable quantities lying at greater depths. Whether this coal is recoverable or not depends of course upon the maximum depth at which it may be found possible to carry on mining operations. The estimated quantity of this coal is

5,236,433,980 tons.

The geological committee, appointed to inquire into the productive measures known or believed to exist outside the areas dealt with by the district commissioners, report that the amount of coal which may be expected to be available in the concealed and unproved coalfields at depths less than 4,000 ft. is

39,843,000,000 tons.

The present annual output is in round numbers 230,000,000 tons.

Almost all the opinions given to the Commission on the general question of coal cutting machines compared with hand labour are in favour of the former, but these opinions are accompanied by many qualifications and exceptions. Other possible economies are suggested, and the evidence shows that seams which cannot now be worked at a profit will in future be rendered profitable by washing, sorting, coking, and briquetting the coal, or converting it into gas, so that no small coal need be left in the mine. With this and other aspects of this important report we hope to deal with in our next issue.

It is announced that Marconi's Wireless Telegraph Company, Ltd., has entered into an agreement with the Oceanic Steam Navigation Company, Ltd. (the White Star Line) for the equipment of six of the White Star Line vessels—the *Oceanic*, *Celtic*, *Baltic*, *Cedric*, *Majestic* and *Teutonic*—with Marconi wireless apparatus.

British Standard Pipe Flanges.

We have just received from Mr. Leslie S. Robertson (secretary) the latest report of the Engineering Standards Committee, dealing with "Pipe Flanges." The publication is one which can scarcely fail to interest a large section of the engineering world, and as will be seen from table IV., reproduced herewith, it is drawn up in great detail. As regards classification of pressures, the committee recommend that flanges, etc., should be standardised in four classes, as follows: (1) Low-pressure standard, for steam pressures up to 55 lb., and water pressures up to 200 lb. per square inch; (2) intermediate-pressure standard, for steam pressures over 55 lb., but not exceeding 125 lb. per square inch; (3) high-pressure standard, for steam pressures over 125 lb., but not exceeding 225 lb. per square inch; (4) extra high-pressure standard, for steam pressures over 225 lb., but not exceeding 325 lb. per square inch.

It was decided that the number of bolts used should in all cases be a multiple of four, and that the bolt-holes should be so placed that spaces between them are bisected by the main centre lines. The Committee are quite aware that in the case of flanges for certain sizes of pipes—and especially of those for 2½-in. pipes—the adoption of multiples of four for the number of bolts involves some change of practice; but, after carefully discussing the opinions and experimental data brought before them, they are convinced that the advantages resulting from the adoption of such a principle outweigh the disadvantages.

For determining the sizes of bolts, it has been assumed that, in the case of a joint just on the point of leaking, the full working pressure might be exerted over the area of a circle just touching the inner sides of the bolt-holes, and the sectional area of the bolts at the bottom of the threads has been fixed to meet this contingency. In the case of the smaller sizes of pipes, allowances have also been made for undue stresses in making the joints. It is considered desirable that all nuts should be chamfered on the side bearing on the flange, and that the bearing surfaces of the heads, nuts, and flanges should be trued.

The sizes of bolt-holes decided upon were: For ½-in. and ⅝-in. bolts the diameter of the holes to be $\frac{1}{16}$ in. larger than the diameters of the bolts; and for larger sizes of bolts, ⅛ in.

Practically the sizes of flanges are governed by the necessity of adopting such diameters as will meet the requirements of makers of stop-valves and similar fittings. The diameters decided upon by the Committee are the smallest which will satisfy these.

Tables I. and II. deal with the dimensions of the British standard pipe flanges for the different pressures specified above. Table III. shows the dimensions of British standard welded-on flanges for pipe lines for working steam pressures up to 125 lb., 225 lb., and 325 lb. per square inch. Table IV. gives the dimensions of British standard short bends and tees of cast metal for all pressures up to 325 lb. per square inch, and table V. the dimensions of British standard long bends of wrought iron and steel.

The Committee on Pipe Flanges was as follows: Mr. William H. Maw (chairman); Mr. W. E. Smith, C.B., and Engineer-Commander A. R. Emdin, R.N., representing the Admiralty; Messrs. E. B. Ellington, Henry Davey, W. H. Patchell, Andrew Laing, John Steven, J. Dewrance, R. E. Atkinson, T. Hurry Riches, Frank Herbert, J. Hopkinson, Robert Hopkinson, T. Harris Spencer, and G. Watson.

TABLE IV.—DIMENSIONS OF BRITISH STANDARD SHORT BENDS AND TEES OF CAST METAL, FOR ALL PRESSURES UP TO 325 LB. PER SQUARE INCH.

D	C	R	D	C	R
[illegible]	[illegible]	Centre-line	Internal Diameter of Pipe.	[illegible]	Radius of Centre-line of Bend
	ins.	ins.		ins.	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
¾	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	4½	[illegible]	[illegible]	[illegible]	[illegible]
*1¾	4¾	3¼	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	15		[illegible]
[illegible]	5½	[illegible]	[illegible]	10	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	4½	[illegible]		
[illegible]		[illegible]	[illegible]	22	[illegible]
*[illegible]	[illegible]	5¼			[illegible]
[illegible]		5½		[illegible]	
[illegible]		[illegible]	[illegible]	[illegible]	20½
[illegible]		[illegible]	[illegible]	26	[illegible]
[illegible]	[illegible]	[illegible]	24	[illegible]	[illegible]

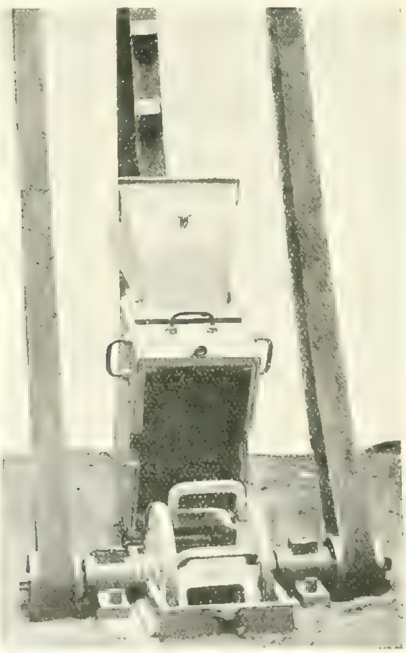
* [illegible]

A New Crushing Machine.

We illustrate, by the courtesy of the Patent Clero Crusher, Ltd., of 65 and 66, Chancery Lane, London, W.C., a new form of crushing machinery, which is likely to play an important part in mining operations.

This is constructed on the principle of centrifugal force and consists mainly of a shaft revolving with a velocity of 1,000 to 1,500 revolutions per minute, to which shaft are keyed two heavy flanges or discs that revolve with it and act as flywheels. In these flanges are journalled a number of successive beaters, usually six, in the shape of cranked axles. The bottom of the apparatus is constituted by two curved perforated plates, each covering one-fourth of the circumference of a circle, and serving as screens to allow of the escape of the disintegrated matter. They are formed in two halves to allow of their being easily withdrawn and replaced without interfering with any other portion of the apparatus. Several steel cushions placed within the rear face of the casing assist in the process of disintegration. A casing and hopper for the introduction of the material to be disintegrated complete the crusher. The casing, with the hopper, pivots round a hinge to facilitate the inspection and cleansing of the apparatus, and the replacement of the beaters and screens.

On the shaft being set in motion, the beaters assume a radial position with respect to the shaft, and strike the material introduced into the hopper, slightly clearing the semi-circular screen fitted in the lower part of the casing.



THE PATENT CLERO CRUSHER.

The particles thus struck are violently thrown against each other, and also against the steel cushions within the casing, and are rapidly reduced to the required degree of fineness when they escape through the screen to be carried away.

This form of crusher claims attention by reason of its simplicity, facility for exchanging parts, portability, small wear and tear, great output and economy of power. It is made in two sizes, 1 and 2, having the following dimensions:—

	Size No. 1.	Size No. 2.
Width of the chamber	16 in.	32 in.
Over the pulleys	43 ,,	90 ,,
Length	27 ,,	55 ,,
Height	32 ,,	62 ,,

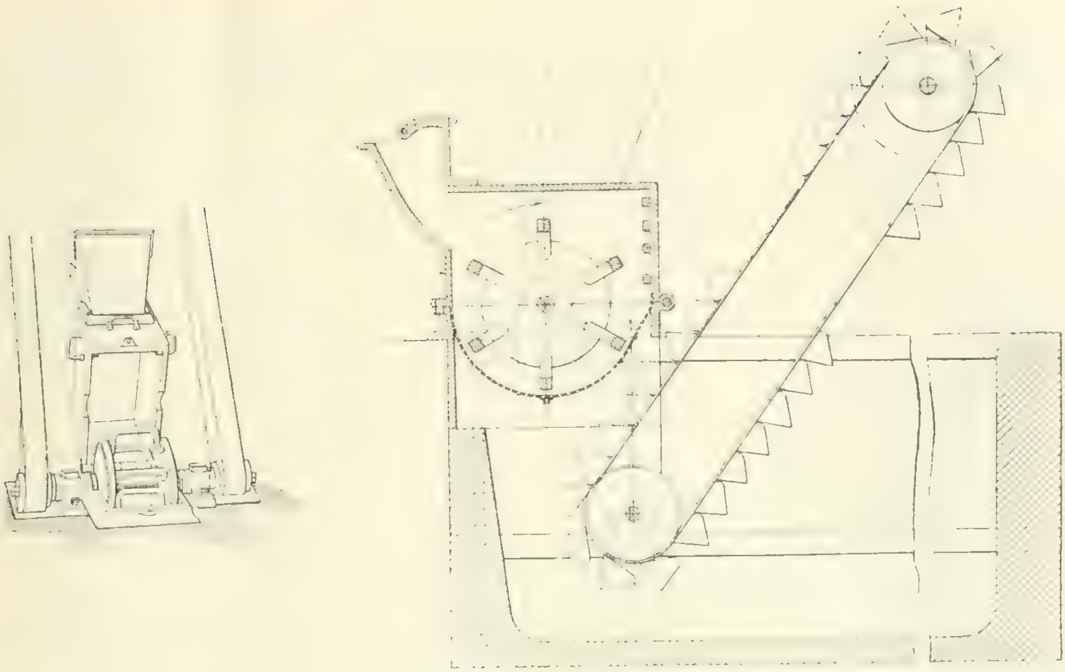
Crusher No. 1 weighs about 1,500 lb., No. 2 about 2 tons and they can also be made in sections. The power required for No. 1 is from 4 to 8 h.p. according to the substance to be ground and the degree of fineness required. The larger size requires from 25 to 30 h.p.

With the above-mentioned h.p. the smaller machine pulverises from 2 to 4 tons per hour of such substances as plaster of Paris, barites, cement clinker, slag, glass, coal, pottery ware, moulders' sand, quartz, mineral ores, etc., etc. The output of the other machine is from 5 to 7 times as large, and we are assured that it will pulverise in one hour as much as 30 tons of gypsum for plaster of Paris, and over 15 tons per hour of such substances as steel slag, quartz, mineral ore, etc.

We understand that some interesting experiments will shortly be made with this appliance. In the meantime, we note that the municipality of Paris has recently granted a concession for the pulverisation of the town refuse of Paris with this form of crusher.

At Paris it has been found that a No. 2 Crusher consuming 30 h.p. will pulverise 10 to 12 tons per hour of town refuse. This refuse is very heterogeneous. It is not previously picked by hand, as it formerly was, but is at once put through the crusher, and it leaves the screen in the form of a blackish mould, perfectly homogeneous, and ready to be delivered at once as manure.

The calendar of the City of Bradford Technical College for the session 1904–1905 is a substantial volume bound in cloth, with some 300 pages of text setting forth detailed particulars of the numerous day and evening classes. The work is divided into three main sections, presided over by Professor A. F. Barker, Professor W. M. Gardner, and Professor G. F. Charnock, M.Inst.C.E., M.I.M.E.



SECTIONAL VIEWS OF CLERO CRUSHER.

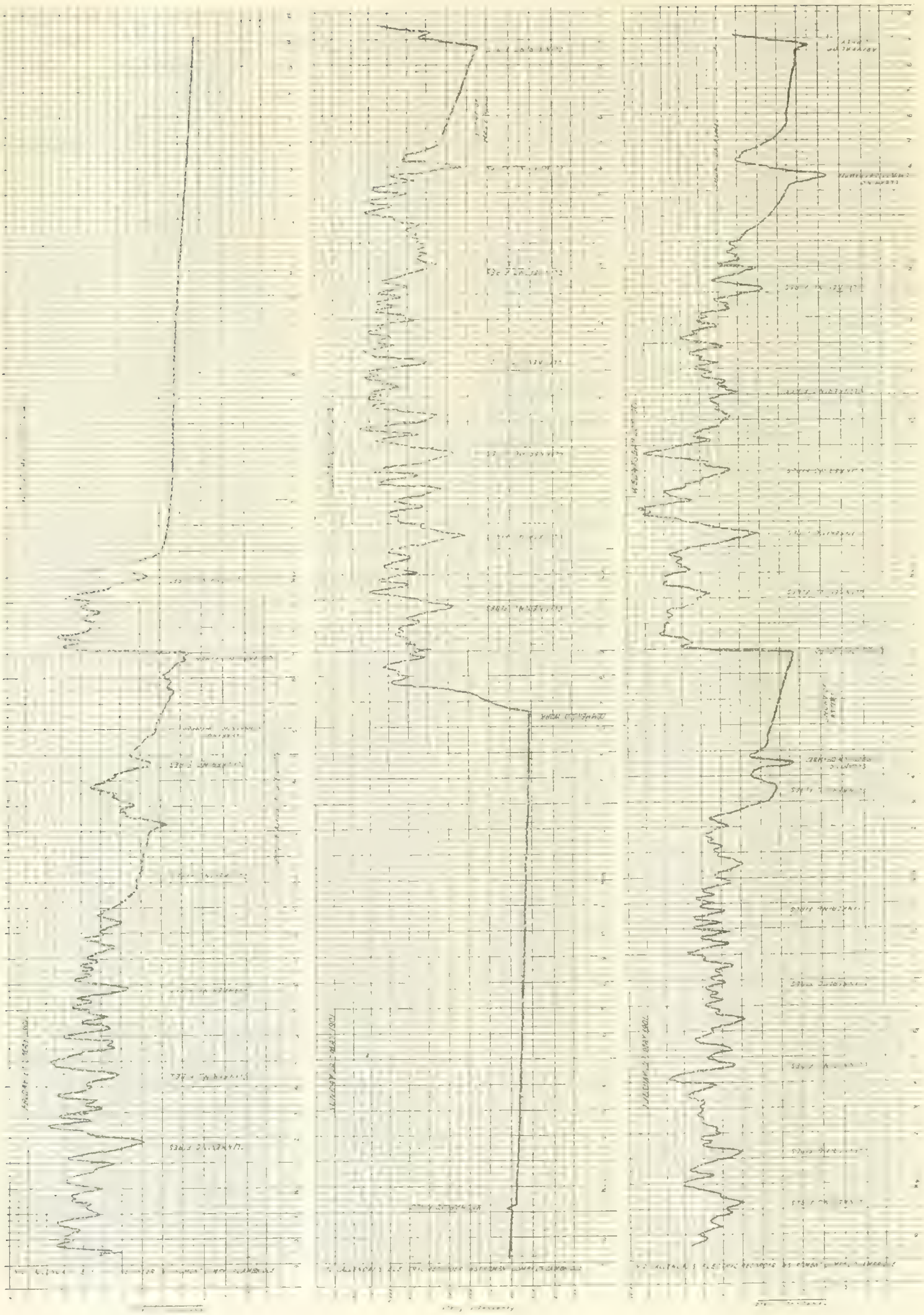
A Destructor Test.

An interesting report by Mr. Stromeyer (of the Manchester Steam Users' Association) has just been received, dealing with a two days' test of the Nelson Destructor. This report has an added interest in view of the calculated composition of the fuel part of the refuse from an analysis of the waste gases. On these tests a Callendar electrical recording pyrometer was fixed in the downtake of the Lancashire boiler connected with the destructor. The accompanying diagram for a week's run is interesting as showing that the temperature during the week-end banking did not fall below 300 deg. F. in the downtake. It will also be noted that the effect on the temperature of every operation of feeding, clinkering, clearing ashes, banking, etc., is duly recorded.

The destructor was designed and erected by Messrs. Meldrum Bros., Ltd., of the engineering works, Timperley, near Manchester, and is of their front feed regenerative simplex type. It has one continuous grate 20 ft. by 5 ft. in a furnace chamber 22 ft. by 6 ft. having four separated and closed ashpits, separately supplied with hot air under pressure. The following is a brief summary of the trial :—

	Tuesday.	Wednesday.
Dates of trials .	13.1.03.	14.1.03.
Time of trials	[illegible]	[illegible]
Duration of trials, hours ..	7·75 ..	9·00
Boiler pressure, mean lb. ..	135·1 ..	134·2
Corresponding temperature .. .. F. ..	358·2	357·8
Refuse burnt during trial .. .. lb. ..	45,410	43,400
Refuse burnt per hour, lb. .	[illegible] .	4,822
Feed water supplied during trial .. lb. ..	63,723 .	67,485
Feed water supply per hour .. .. lb. ..	[illegible] .	7,498
Feed water supply per lb. of fuel .. lb. ..	1.419 .	1.555
Moisture in steam per cent.	[illegible] .	[illegible]
Temperature of feed F. ..	[illegible]	[illegible]
Evaporation per lb. of fuel from and at 212 deg. F. including steam jets, lb.	[illegible] .	1·577

Table II. included in the report, contains details which were only obtainable by making continuous and complete gas analysis, including the moisture in the waste gases. With the help of the information thus obtained it was possible to calculate the chemical composition of the fuel (it contained on an average 31·4 per cent. carbon, and 0·5 per cent, hydrogen), its calorific value (4·6 evaporative units) and the weight of waste products per pound of refuse (5·6 lb.) were then calculated. The heat utilised in the production of steam (exclusive of the blowers), amounted to 36 per cent., which must be considered a high duty when it is seen that the carbon and the heat in the ashes account for a loss of 20 per cent. The heat carried up the chimney amount to an average of 19·3 per cent. which is reasonably low.



NELSON DESTRUCTOR.

Diagram of temperature in Downtake of Lancashire Boiler taken with a Callendar Electrical Recording Pyrometer.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

FRANCE.

THE changes which have been brought into effect in the British Navy during the past few weeks have attracted much attention in France, where the possibility of carrying out similar reforms in the effective list of the French fleet have been widely discussed. Numbers of old torpedo-boats and cruisers are still classed as efficient, but are of absolutely no fighting value. Such vessels as the *Sfax*, *Tage*, *Cécille*, *Isly*, and *Jean Bart* might be relegated to the scrap-heap without in any way affecting the fighting strength of the fleet, and economies in the naval budget would naturally follow.

The trials of the *Dupetit Thouars*, which has been a long time under construction, but which is now ready for service, were fairly satisfactory, and her coal consumption at cruising speed was within a decimal point of the prescribed figure. The *Guichen* has been commissioned, after sundry vicissitudes, but the trials of the *Leon Gambetta* have been postponed,

GERMANY.

That there is every intention of turning Emden, on the north-west coast of Oldenburg, into a naval base, seems certain, and there, as at Wilhelmshaven, large sums are being spent on "improvements." A semi-official report states that the enlargement of the works at Wilhelmshaven has been "rendered necessary by the circumstance that most of the private yards in Germany have accepted orders for Russia, which will keep them fully occupied for years." It is of course well known that the majority of vessels at present building for the German navy have been constructed by contract, and no doubt it is considered advisable to prepare the public yards for any access of works which the acceptance by the Reichstag of a new Navy Act would entail. At Kiel and at Danzig further ships and docks are being built, and where 6,000 men are at present employed it is expected that there will be shortly work for 14,000. Two new protected cruisers, the *München*, and the *Undine*, have been commissioned both at Wilhemshaven on January 11th. The battleship *Lothringen* is also progressing favourably, her funnel and masts being already in place. It is expected that at least one battleship and four armoured cruisers will be launched during 1905, and a large number of vessels should hoist the pennant before next Christmas.

RUSSIA.

The game which Admiral Virenius played round Djibutil, the Red Sea, and the Levant last spring, is to be copied by Admiral Rojestvensky during the next three months, and he is to potter about among the islands of the Indian Ocean, taking care not to go too near the Archipelago. This it is to be presumed is the Russian interpretation of the term "a fleet in being," but how far it will serve to hamper the operations of the Japanese is not easy to determine. That the neutrality of this country and others will be very seriously imperilled with this base-less fleet-errant in search of coal and supplies is obvious, and the fact that the Hamburg American line have reportedly entered into contracts to send sixteen vessels with supplies to any neutral port not east of Colombo during the next three months, points to the likelihood of some island in the Indian Ocean west of the 80th deg. of longitude being chosen for a base. In any case Admiral Rojestvensky has no very heroic role to play. He may neither advance nor recede.

Meanwhile, plans for the re-building of a powerful fleet are maturing, and rumours and denials are rife. The programme published in these columns in the issue of January 13th, was a large one, but it is the only one which up to the present has any semblance of probability about it, and until official information is vouchsafed, if ever, we must be content to look upon that as being the aim of Russia's ambition, so far as a fleet for immediate use is concerned.

ITALY.

Early in the spring, possibly even before the end of February, the armoured cruiser *Francesco Ferrucio* is to join the active squadron in the Mediterranean.

Referring to my remarks last week, on the question of battleships of large dimensions, it may be of interest to note that in an official report on the operations in the Far East, the Italian Ministry of Marine is informed that the existing types of Italian vessels are not adapted to the needs of a long naval war, and two squadrons, of battleships and armoured cruisers should be formed, the first to displace 16,000 tons and over, and the second to be light and rapid, but well armed. Should these recommendations be acted upon, Germany would be the only one among the Great Naval Powers, which continued to build battleships of small displacement.

Design and Construction of American Planing Machines.

By Archibald Kendrick.

BETWEEN this country and America there is a difference of conditions, which manifests itself all through the design and construction of a machine, from the general features down to the smallest detail.

Thus there are many instances of American firms specialising in one tool and adhering to standard patterns even in this. Great excellence of quality and refinement of detail is the result.

Several works where planing machines are made have been visited by the writer, and machines were seen in operation in many places. The machines seen in America were made of distinctly thin metal throughout and the outside appearance was everything that could be desired. Better shapes can be given to castings if their models are kept standard and are not altered. In one works, to economise shop room, only the cross-slides, boxes, gearing, feed motion and other light parts were made to stock. The heavier parts were cast, and quickly got up when an order was received.

Beds mostly have the usual V's, planed considerably more acute than 90 deg., and are generally lubricated with rollers. The V has the advantage of requiring no setting-up slips; while flat ways are easier to lubricate, to get true on foundations and to keep true afterwards; all especially useful for long machines. Flat ways also are better for heavy work. In the larger sizes many new machines are being made with a guiding V on one side and a flat on the other

Tables are furnished with longitudinal T-grooves and dog-holes at intervals. The cross-slides have a rectangular guide at the top with some sort of slip, and a V-guide near the bottom (fig. 1). American machines do not plane on the return stroke, and this arrangement forms a first-class support for the cutting stroke.

Reference should be made to the great precision of the work and to the steady running secured.

NEW DEVICES FOR DRIVING.

Some firms employ friction clutches in the drive instead of belt striking gear, especially for the larger machines. These are easier to throw than belts, and they give rise to less variation in the length of stroke. Still better results in this direction were obtained by a new device seen on an 8-foot square machine, where at the points of reversal a cock opens admitting compressed air which blows the clutch across

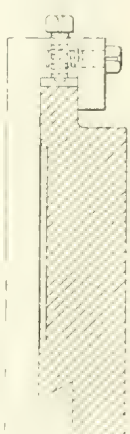


FIG. 1. SECTION OF CROSS-SLIDE CARRYING TOOL-BOX SADDLE.

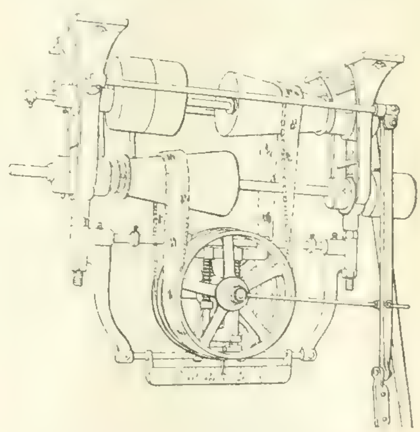


FIG. 2. SPEED-CHANGING DEVICE.

from one gear to the other. Friction-clutch machines are motor-driven very conveniently without a countershaft. Two other forms of drive were seen at Cleveland in which electricity played a prominent part in reversing. In one, an electro-magnetic clutch was pulled alternately to the direct and to the reverse gear. In the other, the knockers threw a switch which reversed the field magnetism and so the rotation of the motor, and also gave it a quick return speed. It was done by a new type of Westinghouse motor which was attached to one of their existing machines. This seems to be the most direct way of all.

In American planers a very high rate of speed is obtained on the quick run-back stroke, being about four or five times the cutting speed. But the cutting speed is nothing extraordinary, and the quick-cutting steels do not seem to have asserted themselves yet. When they do, they will raise the speed of the cutting stroke, but not that of the return, which is probably already as high as is feasible. The next step may be to run the machine at a constant high speed both strokes, and cut with double-cutting tool-holders. In several works where they wished to increase the output of existing machines, planers were run from a Reeve's variable speed countershaft, which gave great satisfaction.

Another new speed-changing device was shown at the World's Fair. This was based on the familiar apparatus consisting of two cast-iron taper cones geared together by a belt with forks to locate the belt and keep it from climbing. For the forks were substituted two guide pulleys as shown in fig. 2. This arrangement allows a good length of belt, and obviates the continual friction on the forks. The belt was a link belt (though it might have been a common belt), and was kept tight by springs acting on the guide pulleys. It worked well and had great driving power.

Abstract of a paper read before the Institution of Mechanical Engineers.

Mallet Articulated Compound Locomotive (B. and O. R. R.)

BY THE AMERICAN LOCOMOTIVE COMPANY

THE following are the chief dimensions and details of the locomotive illustrated on pages 190 and 191 :—

Class	0-6-6-0.
Gauge	4 ft. 8½ in.
Fuel	Soft coal.
Weight on drivers	334,500 lb.
Weight, total	334,500 lb.
Weight, tender, loaded	143,000 lb.
Wheel base, total, of engine	30 ft. 8 in
Wheel base, rigid	10ft
Wheel base, total (engine and tender) ..	64 ft. 7 in.
Length over all, engine	51 ft. 5½ in
Length over all, total, engine and tender ..	80 ft.
Height, centre off boiler above rails ..	10 ft.
Height of stack above rails	15 ft.
Heating surface, firebox	219 square feet.
Heating surface, tubes	5,366 square feet.
Heating surface, total	5,585 square feet.
Great area	72 square feet.
Drivers, diameter	56 in
Journals, driving axle, size ..	9 in. by 13 in.
Main crank pin, size and length of ..	6½ in. by 7 in.
Cylinders, diameter	20 in. and 32 in
Piston stroke	32 in
Piston rod, diameter	3¾ in.
Main rod, length centre to centre	9 ft. 7¼ in.
Steam ports, length ..	h.p. 23½ in., l.p. 20 in.
Steam ports, width	h.p. 1¾ in., l.p. 2⅜ in.
Exhaust ports, length ..	h.p. 23¼ in., l.p. 20 in.
Exhaust ports, width ..	h.p. 1¾ in., l.p. 3 in.
Bridge, width	l.p. 1¼ in.
Valves, kind of	h.p. 10 in., piston l.p. slide
Valves, greatest travel	6 in.
Valves, outside lap	h.p. 1⅛ in., l.p. 1 in.
Valves, inside lap or clearance	h.p. ¼ in., l.p. ¼ in.
Valves, lead in full gear ..	h.p. ⅛ in., l.p. ⅛ in
Boiler, type of	Straight.
Boiler, working steam pressure	235 lb.
Boiler, material in barrel	Worth steel.
Boiler, thickness of material in barrel ..	1 in.
Boiler, diameter of barrel	First ring 84 in.
Seams, kind of horizontal.	Butt jointed, sextuple riveted
Seams, kind of circumferential	Double riveted.
Thickness of tube sheets ..	½ in. back, ¾ in. front.
Thickness of crown sheet	7-16 in.
Crown sheet stayed with	Radial stays.
Firebox, length	108 in.
Firebox, width	96 in.
Firebox, depth, front	80 in.
Firebox, depth, back	72 in.
Firebox, thickness of side and back sheets ..	⅜ in.
Firebox, water space, width, front ..	6 in., sides 5 in
Grate, kind of	Rocking
Tubes, number	436
Tubes, material	Charcoal iron.
Tubes, outside diameter	2¼ in.
Tubes, length over sheets	21 ft.
Smokebox, diameter	85 in.
Smokebox, length	84 in.
Exhaust nozzle., diameter	5½ in.
Stack, diameter	20 in.

STEEL FOR THE MANUFACTURE OF ARTILLERY.

By Colonel Cubillo (Spanish Royal Artillery).

IV.

(Continued from page 120.)

HAVING referred to the companies which provide the first materials for the national arsenals, it will be interesting to examine the works of the latter—their principal features and methods of construction. The only national factories I have visited are the Naval Arsenal at Washington, the old parks or arsenals of Watervliet and Watertown, and, lastly, the rifle factory at Springfield.

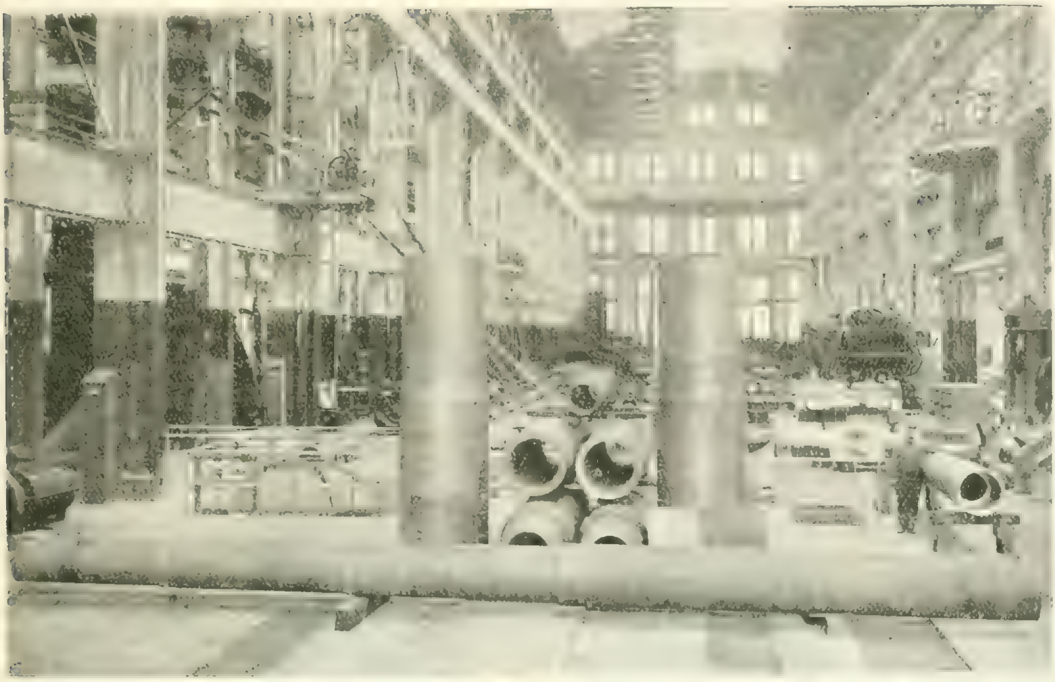
THE WASHINGTON ARSENAL.

This is situated in the federal district of Columbia, on the river Potomac. The depth of water is more than sufficient to allow the entry of the required raw materials and to despatch the finished products to the proving grounds, or other destination. The situation is such that it is covered from attack by a hostile fleet, and its communication lines, including the points which provide its raw materials, are in no danger of being destroyed by an enemy.

When the Government decided to establish its naval arsenal at Washington, the reforms necessary were by no means inconsiderable. The old shipbuilding sheds had to be demolished and replaced by new ones. Other modifications have had to be made to suit the present requirements, as in the case of the old arsenal reconstructed after its destruction by the English in 1814, from the slips of which were launched the famous frigates *Columbia* and *Potomac*, now used as an artillery workshop. The most important shops of the arsenal are: the cannon shop, divided into two sections, north and south; the carriage shops, in two sections, east and west; the lock mechanism; the forging and pattern shops; the foundry; metallic cartridge department and the tool shop. In the gun shop, one naval lieutenant is in charge of the manufacture of the 4-in., 5-in., 6-in., and 7-in. guns; there is another for the 8-in. to 13-in. guns, and a third lieutenant attends to the 3-in. guns, and all kinds of accessories. There are three powerful electric cranes worked by eight electric motors.

In the centre of the workshop is the shrinking pit, which is made of sufficient depth to receive the tubes of the largest guns, and vertical gas furnaces; also to heat sleeves of the greatest dimension. The hoops and short sleeves are placed horizontally. The tools employed in the boring and screwing are similar to those now used in Trubia, where American tools have been used with great advantage. In one thing the Washington Arsenal is ahead of Trubia—the rifling head carries four tools instead of one, and does the work in a third of the time. This cannon workshop contains 151 machines of all kinds. I think it a very good idea to have the lock-mechanism shop in a different part of the building provided with 113 machines. The carriage department employs 237 machines, 28 of which are horizontal boring machines, well adapted for the construction of the gun cradles.

Another worthy of notice is the forging shop; this is not limited to pieces which may be forged by a one-ton hammer, of single or double action, but undertakes forgings of much greater weight. A twenty-five-ton crane runs from end to end of the shop. In the pattern department great improvements have been made during the past year; the system for the expulsion of the sawdust into a collector placed outside being one of the most important; the shavings are also disposed of in a similar manner after separation from the machines by



GROUP OF NICKEL STEEL FORGINGS FOR 8-IN. AND 10-IN. RIFLES, BY THE MIDVALE STEEL COMPANY.

A description of the factory will be found on page 12, No. 17

means of electrically-driven fans; this method saves hand-labour and diminishes the risk from fire. The metallic-cartridge department is very similar to the one at Trubia, but more complete. The Americans smelt and roll the brass required; Trubia starts with the metal in discs. As regards the rest, the pumps and accumulators, the vertical press to make the cup, the horizontals and the two of 2,500 and 1,000 tons, to head the cartridges, are exactly like those at Trubia.

The American factory has also some smaller presses for the manufacture of 75-millimetre cartridges. The draughtsman's department of this arsenal calls for special notice. In the year 1902, 880 original plans were prepared, and 28,000 blue print copies were distributed among the different branches of the naval service. The department had to be increased last year, owing to the great amount of work. All plans are kept in fireproof safes.

Instead of publishing and sending the drawings of artillery material to the officers, the Washington Arsenal had photographic reductions made, conveniently classified and bound in book form. In this way each vessel has a complete plan of all its artillery.

I will now give a few details regarding the annual expenditure and production. From May, 1887, when the works were first started, until the end of June, 1902, 1,210 guns of all calibres had been made, and 281 were still in hand. The cost of hand-labour increased from \$210,093 in 1886–7, to \$1,746,168 in 1901–2. The machines at the end of 1902 numbered 1,223 of all classes, having increased from 405 in the last ten years. Lastly, there are nineteen officials and 2,115 workmen.

As happens in all navies and armies, the Americans construct different models of the same calibre; but it appears that they are going to adopt, or have already adopted, a fixed criterion as regards the length of the gun, assigning forty calibres to the 12 in. and 10 in.; forty-five to the 8 in., 7 in., and 6 in.; and fifty to the 6 in., 5 in., 4 in., and some of the 3 in. There are also 3-in.

semi-automatic Maxim-Nordenfeldts and Driggs-Seabury Company guns.

The American Navy is well satisfied with the results obtained with the Firth-Stirling projectiles, which combine the advantages of armour-piercing and ordinary shells, that is to say, they pierce the armour and carry more than a medium explosive charge if desired. The test for these projectiles is the following : At a certain velocity they must pierce a hardened plate of one calibre thickness, and then explode.

American officers do not think that we have reached the power limit of artillery. They intend to adopt a pressure of 3,000 kilogrammes per square centimetre as the normal for steel pieces ; the length to be fifty calibres for the 6-in., 7-in., and 8-in. guns, and the metal to be nickel-steel.

Adjacent to the proving ground at Indian Head the American Government has constructed a smokeless powder factory. Last year 496,353 lb. of powder were made, to produce which 378,500 lb. of ether, 1,275,492 lb. of sulphuric acid, and 516,575 lb. of gun-cotton were used. The factory is capable of producing 3,000 lb. of powder daily ; except in the summer months, when, owing to scarcity of water, only 2,400 lb. can be made.

Experiments have been made with a colouring matter, which should indicate on the decomposition of the powder, and consequent alteration in colour, the stability of the explosive. The director of the factory is of opinion that this test should be employed to avoid the necessity of the inspections which are now practised.

(*To be continued.*)

SHRINKAGE PIT AND FURNACES IN NO. 2 GUN SHOP EXTENSION—MIDVALE STEEL COMPANY.

OUR WEEKLY BIOGRAPHY.

MR. WILLIAM JACKS, J.P., LL.D.

MR. WILLIAM JACKS, formerly Member of Parliament for Leith and Stirlingshire, founder of the well-known firm of iron and steel merchants, was born March 18th, 1841, at Cornhill-on-Tweed. He was educated at the village school, Swinton, Berwickshire; the training he received there, however, was only of an elementary nature, but he was an enthusiastic student and the desire for knowledge acquired in his early youth proved a strong factor in the formation of his character.

His business career began in 1855 when he was apprenticed to a shipbuilder at West Hartlepool. Upon the expiry of his time, he entered the counting-house of a ship-building firm on the banks of the Wear. When not engaged in business his leisure hours were judiciously divided between the study of modern languages, German literature, mathematics, political economy, etc.

Photo by Elliott and Fry

MR. WILLIAM JACKS, J.P., LL.D.

In 1863 he was appointed manager of the Sunderland and Seaham Engine Works and Foundry. Six years later he became manager of Messrs. Robinows and Marjoribanks, foreign iron merchants, Glasgow. He eventually retired from this firm in order to establish his own business as an iron and steel merchant. Apart from the management of Messrs. W. Jacks and Co. (London, Glasgow, and Middlesbrough), Mr. Jacks is also a director of several large limited companies, and is financially interested in iron and steel works in Britain and in Canada.

In 1885 he entered upon his parliamentary career as member for Leith Burghs, while in 1892 he was again returned to the House of Commons as the representative of Stirlingshire.

In 1901 he was elected President of the West of Scotland Iron and Steel Institute, and was for several years, president of the British Iron Trade Association, and is now President of the Glasgow Chamber of Commerce.

Mr. Jacks is very enthusiastic on the subject of commercial education, and is president of the Council of the Commercial College, Glasgow. He is of opinion that boys obtain a better training in a properly conducted office and in the efficiently equipped night schools than they get in ordinary educational institutions. A strong advocate of the system of profit sharing as a a remedy for strikes, Mr. Jacks adopts the plan in his own business and tries to introduce it wherever possible. The honorary degree of LL.D. was conferred upon him by the University of Glasgow for his contributions to literature.

QUESTIONS OF THE DAY

The National Encouragement of the British Inventor: How can it be secured?

(Continued from page 125.)

MR. THWAITE now concludes his reply to correspondents in this important discussion, as follows :—

THE DEADENING EFFECT ON A NATION'S PROGRESS OF A NON-PATENT POLICY.

It is suggested by only one of your correspondents (Mr. Erith) that most of the inventions would be developed irrespective of patent protection. I would like to ask him how many inventions have been developed in Holland ?

No manufacturer would risk the expenditure involved in the technical and commercial perfection of an invention unless he was satisfied that he had at least a problematical chance of establishing a proprietorship under the ægis of a patent.

Your correspondent draws attention to the renewal fees in force in Germany. I may tell him, from intimate experience, that as regards German patents granted (to Germans) after the search by an exceptionally practical staff, had it not been for the strongly protectionist fiscal policy, and the mercantile banking system which this policy has created, the objectional renewal fee taxation of this German patent system would long ago have suppressed the public exhibition of a great part of German inventive effort.

THE INFLUENCE OF THE AMERICAN PATENT POLICY ON THE PROGRESS OF THAT COUNTRY.

My knowledge of the causes furnishing the American prosperity can be found by your correspondents in the "American Invasion," one of the "Burning Question" series published by Messrs. Swan Sonnenschein and Co., London, as to the effect of the American cheap patent policy. The best judges are the experts at the head of the American Patent Department. I give an expression of opinion from this source, selected from others equally as emphatic, by Commissioner C. H. Divell.

"I assert without fear of contradiction, that we Americans owe to our patent system such foothold as we have gained in foreign lands for our manufactured products."

I commend this opinion to the notice of your correspondent, Mr. Erith. One of your correspondents expresses the opinion that because a demand is established for a foreign manufactured patented article, this justifies its introduction into this country under the ægis of an unworked patent, prohibiting for long years the home manufacture of an article that may displace another home-made product. This exhibits a strange ignorance of the effect of the policy permissible in the old Act, which has played sad havoc with some of the Lancashire and Yorkshire chemical manufacturing industries. No! A reciprocal compulsory working policy is the one to be recommended. The subject of a country which places our inventions under a working obligation should receive the same treatment in this country.*

THE WEALTH OF ANY COUNTRY DEPENDS ALMOST ENTIRELY UPON THE INVENTIVENESS OF ITS INHABITANTS.

Some years ago I received special and valuable data from the United States Census Department, by which I was able to draw a comparison between the wealth *per capita* of different states, and its relation to the inventiveness of such States.

For example, the wealth of the following States—

* A German inventor establishes in his country a manufactory. He refuses to licence the right of manufacture in this country except on impossible terms, and as the law exists, no one can blame him. During the years of his monopoly of importation into this country, he perfects his machinery, and his workmen become experts; he extends the life of his patents whenever possible by patenting details, so that when his British patent life expires, he relies on his detail patents. Thus the establishment of the British factory is indefinitely deferred.

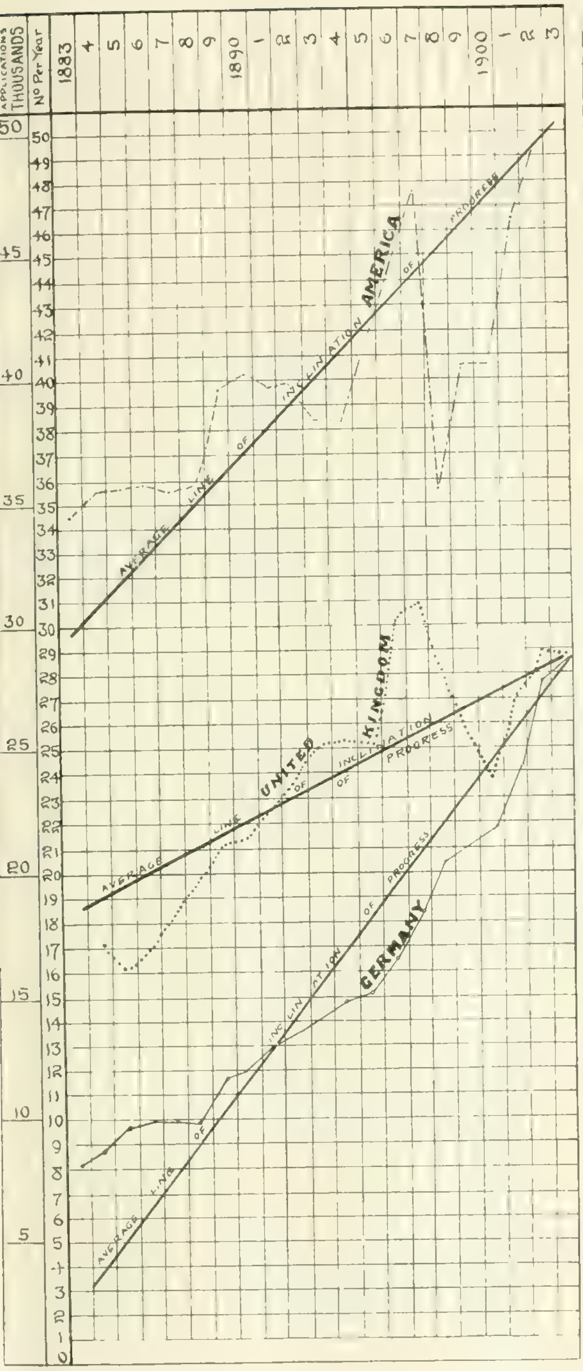


FIG. 2.

Diagram showing progress of inventive activity in America, the United Kingdom, and Germany during the twenty years ending 1903.

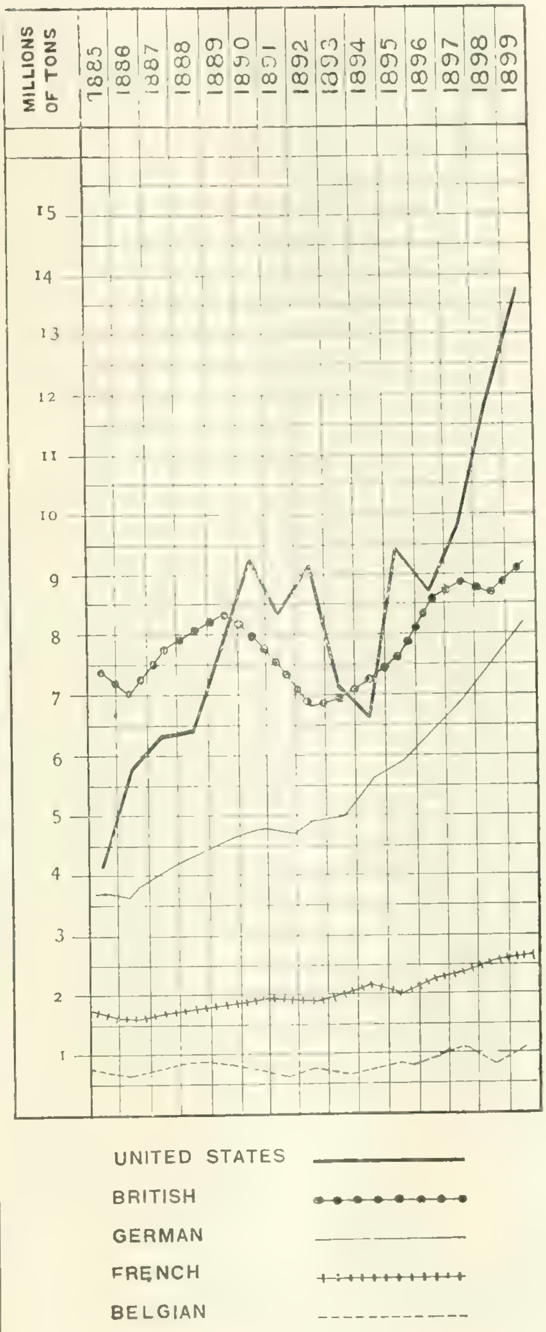


FIG. 4.

Showing comparative progress of the five great iron-producing countries in the production of pig-iron—1885-1899.

Massachusetts, New Jersey, Rhode Island, Colorado, Montana, District of Columbia and Connecticut, if distributed to each unit of population would be equal to the division of $682 per head. In these States one American patent in each group of 1,108 of the population is annually applied for.

If distributed to each unit of population of the following least inventive of the American States—Virginia, West Virginia, Arkansas, Tennessee, Georgia, Mississippi and South Carolina, the wealth would provide only $176 per head of population. In these seven states only one patent is annually applied for to each group of 15,550 inhabitants.

It may therefore be said that the comparative material advance and prosperity of a country can be measured by the patents annually applied for, compared with the population.

STATE INDIFFERENCE TO THE INVENTOR.

If one required to demonstrate how indifferent the British Government—Tory or Radical—is to the all-important subject (according to George Washington) of providing adequate encouragement and protection for inventors, one need only refer to the character of the Royal Commission (and its evidence) appointed and arranged to investigate the defects of the existing Patents for Inventions Act, and formulate remedying reforms. Such a Commission in other countries would have been constituted with at least 50 per cent. of inventors, and 90 per cent. of the witnesses at least, would have belonged to the inventor's class for which the Act under consideration directly affects. But no! The opinion of the inventors of the country was practically ignored, and only one-tenth part of the evidence could, by any stretch of imagination, be termed the representative opinion of the British inventor.

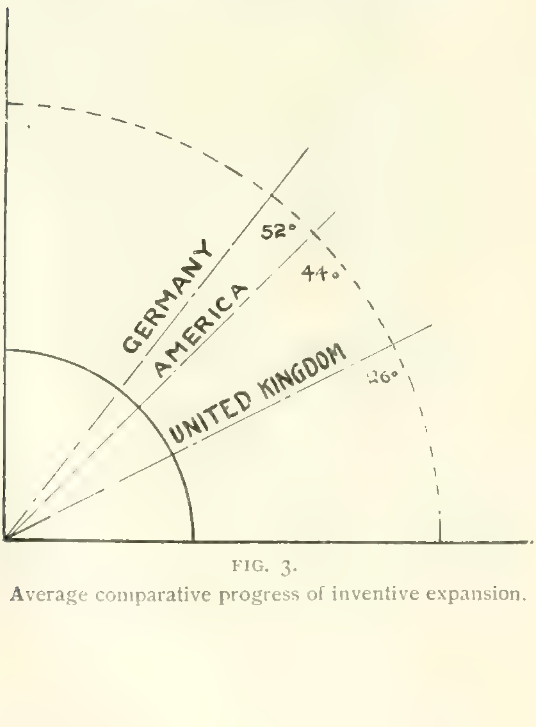


FIG. 3.
Average comparative progress of inventive expansion.

The graphic diagram (fig. 5) is quite eloquent on this point. The subject under discussion is not a political one, but it may, nevertheless, be observed that if this *laisser faire* (others call it *blundering* policy) is allowed to continue; our commercial and industrial efficiency, when tested in the balance against the cosmic and inventor-encouraging organisations of our great competitors, will be still further outweighed.

Mr. Abel, in his thoughtful and appreciated address, draws attention to the magnificence of the German and the American Patent Office Buildings. Let anyone compare these temples and their splendid sites with the character and position of the new British Patent Offices, and he has an ocular demonstration of the comparative estimation of inventors by the three countries.

HOW THE GERMAN AND AMERICAN INVENTORS ARE ASSISTED IN THE WORK OF COMMERCIAL PROTECTION AND EXPLOITATION OF THEIR INVENTIONS.

The British inventor has not, like his German contemporary, the advantage of the splendid stimulus to enterprise represented by the German Mercantile Banking system—by which selected inventions of promise are developed, and commercially introduced under the best conditions to secure success. This Mercantile Banking System, protected as it is by the Bismarck policy of strong Protection, is responsible for a part of the marvellous progress of Germany during the last twenty years, a reference to the graphic diagrams (figs. 3 and 4) show the remarkable development of inventive activity in Germany, and the extraordinary correlation of the progress of the iron-making industry with the expansion of inventive effort. The American inventor has the advantage of the remarkable enterprise of the United States, fostered as it was by the effect of the McKinley fiscal policy.

If we cannot have a strong Protectionist fiscal policy, let our inventors, therefore, have, at least, the encouragement that can be given to them by a wise and generous Patent Act.

THE COMPULSORY SUBDIVISION OF AN INVENTION INTO SEVERAL PATENTS, AND ITS EFFECT.

The Comptroller under the provisions of the new Act, may require an inventor to apply for two patents, or even three, as is done, and very rightly, by the United States Patent Office, assuming that an invention requires to be covered by three applications, thus the patent fees cost to the applicant for a 14 years' life will approach to the figure of £300, independently of agent's charges. The fees for the three applications

in the United States for a life period of 17 years will not exceed £25, or exactly one-twelfth of the British charges. The effect of such taxation can easily be foreseen. The disastrous effect of the British renewal fees of the old Act is serious enough, but the effect of the new Act of Sub-division, if insisted upon, will probably extinguish the life of 90 per cent. of British patents after the fifth year.

THE OFFICIAL EXHIBITION OF ANTICIPATIONS.

In my opening letter I particularly pointed out that one of the defects of the new Act is the power it gives to the Comptroller of the British Patent Office to destroy the commercial, or indeed any proprietary value of a patent, by published references to (arbitrarily defined) anticipations, and on the face of the patent specification, I notice that this regulation is being condemned by eminent patent experts. It is suggested that in lieu of this regulation, option should be given by the Comptroller to the inventor applying for a patent to interpolate in the usual disclaiming terms, in the body of his specification, a repudiation of any intent to encroach on the proprietary rights of any of the patents considered by the Comptroller to constitute anticipations, but not necessarily accepted as such by the applicant for a patent.

THE TRUE INDEX OF A NATION'S INDUSTRIAL PROGRESS AND COMPARATIVE PROSPERITY.

Years ago I laid down the proposition that the true index of any nation's industrial and commercial position was not that of the Disraelian axiom, *ergo*, the state of the Chemical Industry—but that of the Iron and Steel Industry—but there is another index almost as valuable and true, and that is the degree of activity of a nation's inventive faculty, represented by the numerical proportion of the applicants for patents for inventions.

A comparison instituted between the proportion of the application for patents in the three countries, America, Germany, and the United Kingdom, is of peculiar value, as an index of comparative progress.*

I have built up in a graphic form fig. 2, on the basis of official statistics, lines representing the proportions of the total applications for patents for different years, beginning in 1883, and ending in 1903.

Along these lines I have drawn others that represent the average progress over the period time defined. These lines are reproduced—projecting from a common centre in fig. 3—showing at a glance the average comparative progress of inventive expansion in each of the three countries, in definite degrees.

A GRAPHIC COMPARATIVE EXHIBIT.

Let anyone compare the graphic diagram (fig. 2) with the graphic diagram (fig. 4) showing the comparative progress in the great iron-making countries

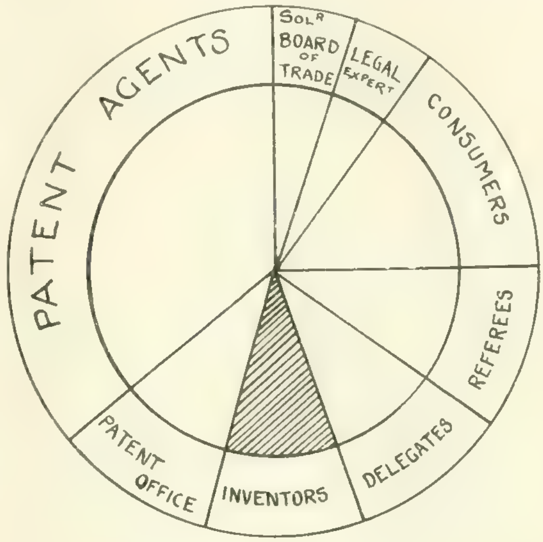


FIG. 5.
Diagram showing constitution of the Commission responsible for the provisions of the new Patent Act.

in their pig-iron output capacity. It will be noticed, especially applied to Germany, that there is a very remarkable correlation between the inventive activity and that of the iron industry during the last twenty years. The correlation exists, but not to the same extent between the activity of the American iron industry, and that of American inventors. The same comparison applied to the last ten years would to a more serious extent, weigh against this country.

OBITUARY.

The news of the death of Mr. Wm. Jaffrey has been received with great regret in engineering circles. Mr. Jaffrey had a long and varied experience as an engineer, and played a prominent part in the inception of many important enterprises. From the date of his association with Mr. Kinipple in 1889, he specialised in dock and harbour work, and among other undertakings was associated with the extension of the London docks, and with the engineering work on the Essex and Suffolk coasts, undertaken by the East Coast Development Company. Mr. Jaffrey was also engineer to the Commissioners of Sewers, and to the Aden Port Trust. He was a member of the Institutions of Civil Engineers and Mining Engineers, his earlier years having been mainly devoted to mining work.

* By the way there is a misprint in the footnote on page [illegible]. It should read as follows: "Foreign inventors should be compelled to apply for British patents in their own names, otherwise they could easily evade the compulsory working condition of a reciprocal policy by arranging for their patents to be taken out by a secret service agent located in this country. This points to the desirability of extending the search for anticipations, so as to cover foreign applications for patents."—B. H. T.

LOCOMOTIVE NOTES.

By Charles Rous-Marten.

NEW BIG-BOILERED "ATLANTICS."

Apparently the fact that no fewer than twenty-one of the large boilered "Atlantic" engines are now at work on the Great Northern Railway and ten on the North-Eastern must be taken to indicate that Mr. Ivatt and Mr. Worsdell at any rate, deem the single-expansion locomotive type, fortified by a boiler of gigantic dimensions, preferable to the system which has mainly commended itself to the rest of the world, at any rate to the European Continent, and in a large degree to America also, that of making smaller boiler-power suffice by using the same steam twice over, in other words, by compounding. In view of the large European experience now available—there being already at work on the Continent no fewer than two thousand compound engines of the de Glehn type alone, or at least of the type which, through Monsieur du Bousquet's utterance on the subject, has become known as the de Glehn, although Monsieur de Glehn himself disclaims any exclusive right to the credit—it is not quite easy to understand this attitude. In England, it is true, the general public, until the arrival of "La France," had become accustomed to regard locomotive compounding as inseparable from one of two systems—the Webb on the one hand, the Worsdell-von Borries on the other. The recent rapid and steady march of the Webb three-cylinder compounds to the scrap-heap and of the North-Eastern two-cylinder compounds to the converting shop has doubtless done much to emphasise this idea in the minds of those who have not the means of becoming thoroughly acquainted with the circumstances, but manifestly it would be absurd to predicate any such ignorance on the part of the very eminent engineers who have deliberately preferred the non-compound type. One must take it for granted that they have, as they believe, adequate reason for such a decision. But one would be glad to know what that reason is.

THEIR WORK.

Meanwhile, the huge new North-Easters which are now running regularly to Edinburgh with the East Coast expresses, are settling down into their stride, and must in due time be judged by their work. Now, I have made several observations with these engines and have had a number of observations made for me by entirely trustworthy assistants. But I cannot regard as at all complete the results yet obtained. Some competent judges who have written to me about the engines express disappointment that they have not "done better" than previous four-coupled types, such as Nos. 2011–2030, 2101–2110, etc. I mention this because I wish to have the opportunity of saying that I do not regard such a criticism as entirely apposite. If the previous engines kept time with a given weight of train, I do not see why more should be expected even of the enormously more powerful new engines. I remember the same irrelevant criticism, as I judge it, being applied to Mr. Worsdell's six-coupled ten-wheelers when they first came out. "They don't go up the Cockburnspath bank any better than the other engines," it was remarked to me more than once. But why should they? And why should this be expected of them? What was expected of them, and quite reasonable as I understood, was on the one hand piloting should be reduced with existing train-loads, and on the other that if heavier trains had to be hauled in the same services, the new engines would or should be able to take them to booked time as easily as their predecessors did the smaller loads. That was my argument in the case of the six-coupled class, and I take up the same position now as to the "Atlantic" class. I do not see why they should be expected to haul a given load faster than their predecessors, the booked time remaining the same. What I do say is that they may and should be expected to haul considerably heavier loads to the same time. The question is, do they? It is exceedingly difficult to arrive at any very clear knowledge on such a point as this. The materials for comparison in these cases are almost always insufficient. Cognisance has of course to be taken of the cases in which assistant engines were resorted to by the earlier locomotives; conditions of weather and road have also to be duly allowed for It is seldom practicable or convenient for such absolute tests to be undertaken as the rapid running, by different classes of engines, of trains varying in weight. It is still more difficult to effect comparisons between the locomotives of different railways. Otherwise it would be most interesting to see how the Great Northern

and North-Eastern "Atlantics" would compare with the London and North-Western "Precursors" or with the latest Webb compounds, as modified by Mr. Whale, on such trains as these two latter classes are now taking without pilot aid, *e.g.*, loads of 400 to 500 tons behind the tender, booked over average roads at mean speeds of 51½ to 53 miles an hour from start to stop.

INCONCLUSIVE COMPARISONS.

But even on their own roads the new "Atlantics" cannot well be compared with their predecessors because of the almost infinitely varying conditions. Still, some rough approximation may be feasible. A few days ago, through the courtesy of the Great Northern authorities, I tried one of the new big-boilered Altantics on the 1.30 p.m. Leeds fast express as far as Doncaster, to which point the average speed is within a small fraction of 55 miles an hour with a midway stop at Peterborough. The train may be described as a moderately heavy one, weighing about 280 tons behind the tender. The big engine not only found no difficulty whatever in keeping time with that load at that speed, reaching Doncaster a minute early in spite of an extra signal stop and special delays amounting to about eight minutes in all, but also had to "ease down" at two different points in consequence of being in advance of time, while the speed was deliberately kept under on the down grades. The second stage from Peterborough to Doncaster, 79½ miles, was covered in the quick time of 81 min. 41 sec. start to stop, and could have been done several minutes quicker had the usual high speeds been run down falling gradients. Clearly this was excellent work, and much the same thing was done under my observation by another engine of the same class on the same train on a different day. But was it better than that done by other Great Northern Atlantics with the smaller boilers, 1,444 square feet of heating surface, instead of 2,500 square feet of which 21 have been built? After a careful collation of the respective figures I am inclined to say No; and I may add that my experience has been virtually the same in respect of the big North-Easters. A certain given duty identical as to road, load and speed, was performed by the newer engines practically in the same way as by the older ones. But it would be inaccurate to infer from this that no advantage accrued from their enlargements because in my view the new engines would have made those same runs in just as good time had their loads been increased by 25 or 30 per cent., if not more, whereas the older engines would not. In other words, the new engines have that most valuable possession, a margin of power.

PLANT AT THE MOUNT BISCHOFF TIN MINE.

BEFORE the Institution of Mining and Metallurgy at its last meeting, Mr. Sydney Fawns read a paper on the Mount Bischoff Tin Mine.

The dressing sheds are 1¼ miles from the mine, and transport costs slightly under 1d. per ton. The ore before transport is reduced to a diameter of 2½ in. by rockbreakers. This is hand-fed into a battery, with stamps of the Californian type, 75 heads being in use. The amount crushed by each stamp equals 4·546 tons of ore per twenty-four hours.

The crushed ore after leaving the battery, passes through a careful classification by means of the double-trough-rising current classifiers, the coarse ore being separated from the slimes.

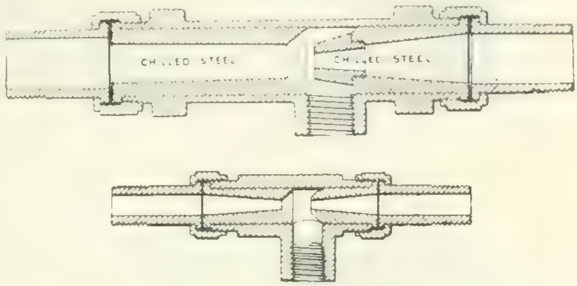
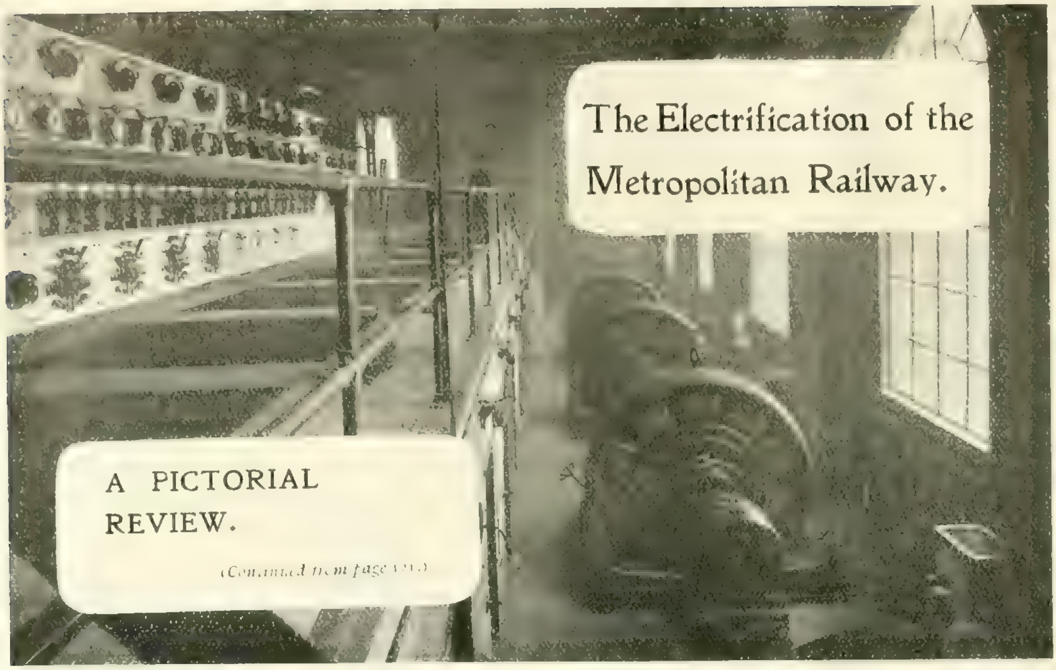


FIG. 1. SECTION OF HYDRAULIC JET ELEVATOR.

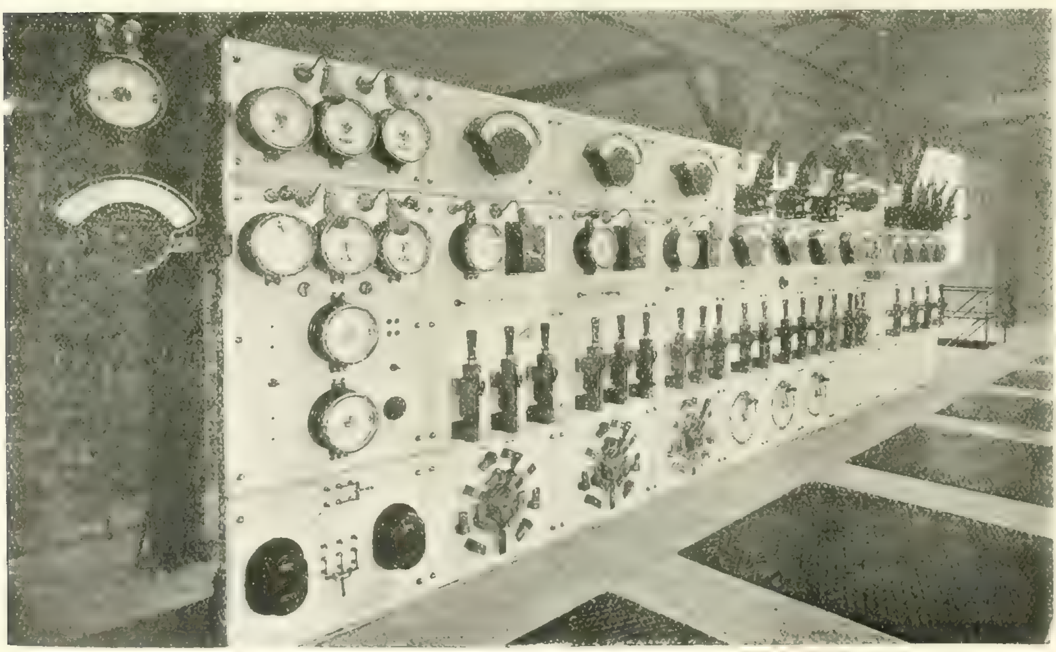
Fig. 1 shows a section of the hydraulic jet elevators which are used extensively in the Bischoff sheds; the jet works silently and requires little attention, the only wearing part being the nipple, which can be replaced in five minutes.

From the classifiers the coarse ore passes into thirty two-compartment Hartz jiggers: those working in coarse sand use sieves of 144 holes to the square inch, and are driven at a speed of 160 strokes of $\frac{3}{16}$ in. to the minute, while those on fine sand have sieves with 196 holes to the square inch, and are driven at 202 $\frac{1}{8}$ in. strokes per minute. The ore then passes to thirty-nine rotating tables. The tables are actuated by worm gearing once in 2½ min., the table treating seven hundredweight of slime per hour, and requiring ¼ h.p. to drive it. Kayser concave buddles are used, working at a speed of 6½ revolutions per minute, and take ¾ h.p. each. The slimes and sands fed on to these buddles are worth 0·25 per cent. of ore. First buddling raises the concentrates to 7 per cent., and re-buddling raises them to 60 per cent. These machines [illegible] per cent. of the [illegible] recovered from the mine.

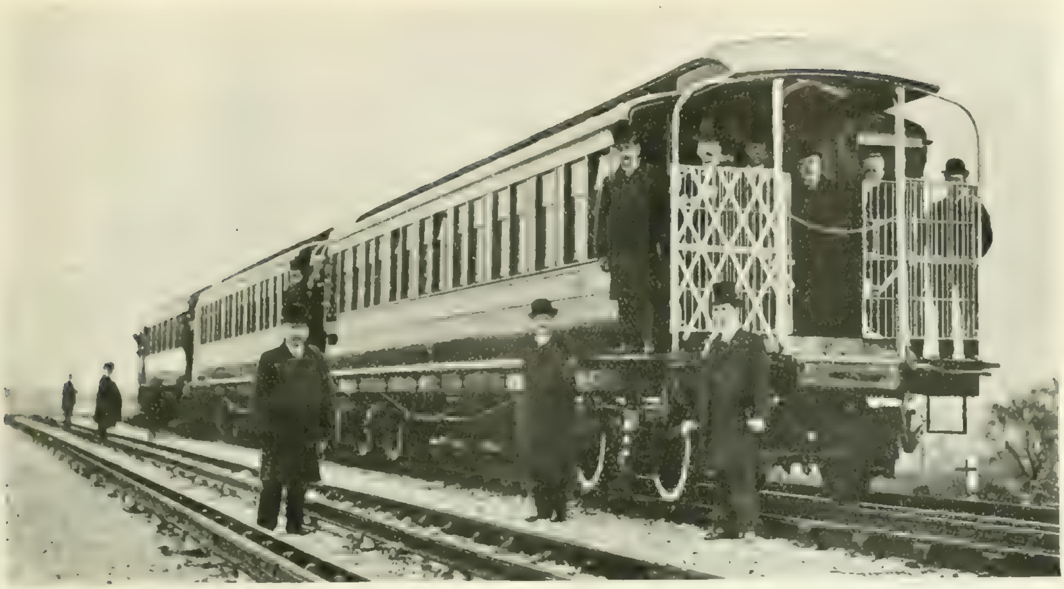


FINCHLEY ROAD SUB-STATION.

The system upon which the railway is operated is the standard one. The 11,000 volt 3-phase current is conducted to the sub-stations by British Insulated and Helsby three-core armoured cables, and there transformed down and changed to direct current at approximately 600 volts by rotary converters. The two sizes of rotary converters employed, 800 kilowatts and 1,200 kilowatts, have respectively 10 and 12 poles, and run at speeds of 400 and 333·3 revolutions per minute. The transformers used in connection with them are of 300-kilowatt and 435-kilowatt capacity per phase, and are of the insulated self-cooling type.



SWITCHBOARD AT THE HARROW SUB-STATION.



ONE OF THE NEW METROPOLITAN TRAINS.

The new rolling stock of the Metropolitan Railway is all of the corridor type, with longitudinal and transverse seats. The cars are 52½ ft. long, and are mounted on two pressed steel four-wheel bogie trucks of English manufacture; their weight is approximately 39 tons. Each motor-car, of which there are two in a train of six coaches, is equipped with four 150-h.p. British Westinghouse railway motors, one for each axel of the truck; there will, therefore, be the unusual amount of 1,200 h.p. available for propelling each train.

CAR INTERIOR.

Sliding doors are fitted at the ends of the cars, and patent swing gates give ready and ample access to the station platforms. All the rolling stock has been built at Birmingham and Manchester by the Metropolitan Amalgamated Railway Carriage and Wagon Company, Ltd., under the immediate supervision of the Railway Company's carriage and wagon superinendent, the entire electrical equipment being designed by the British Westinghouse Company.

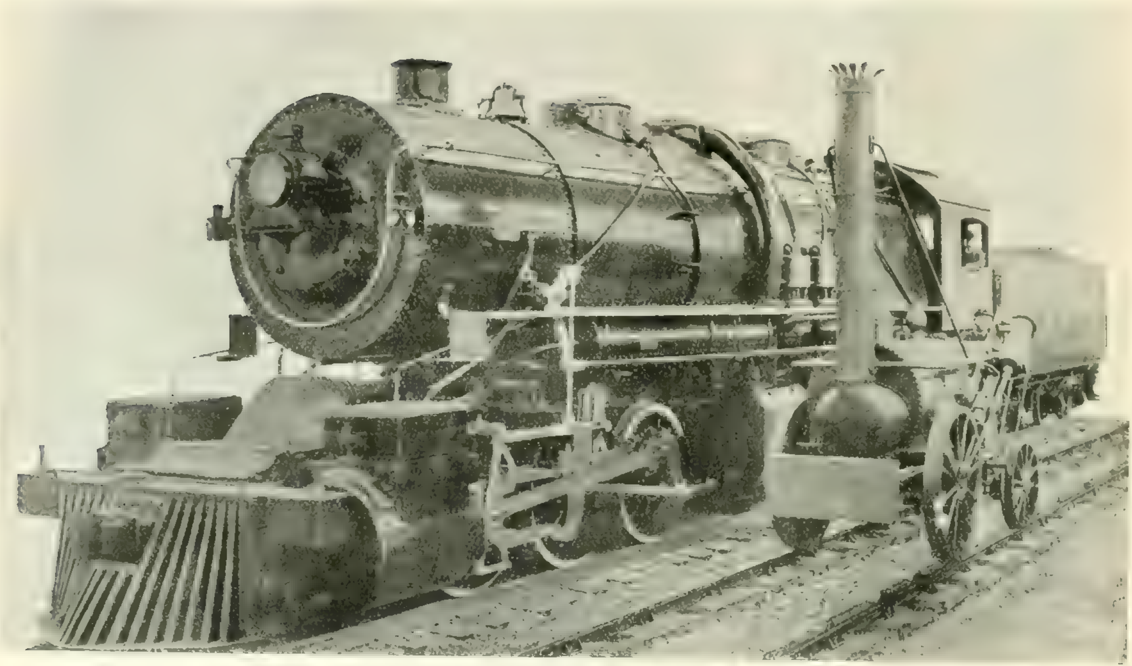
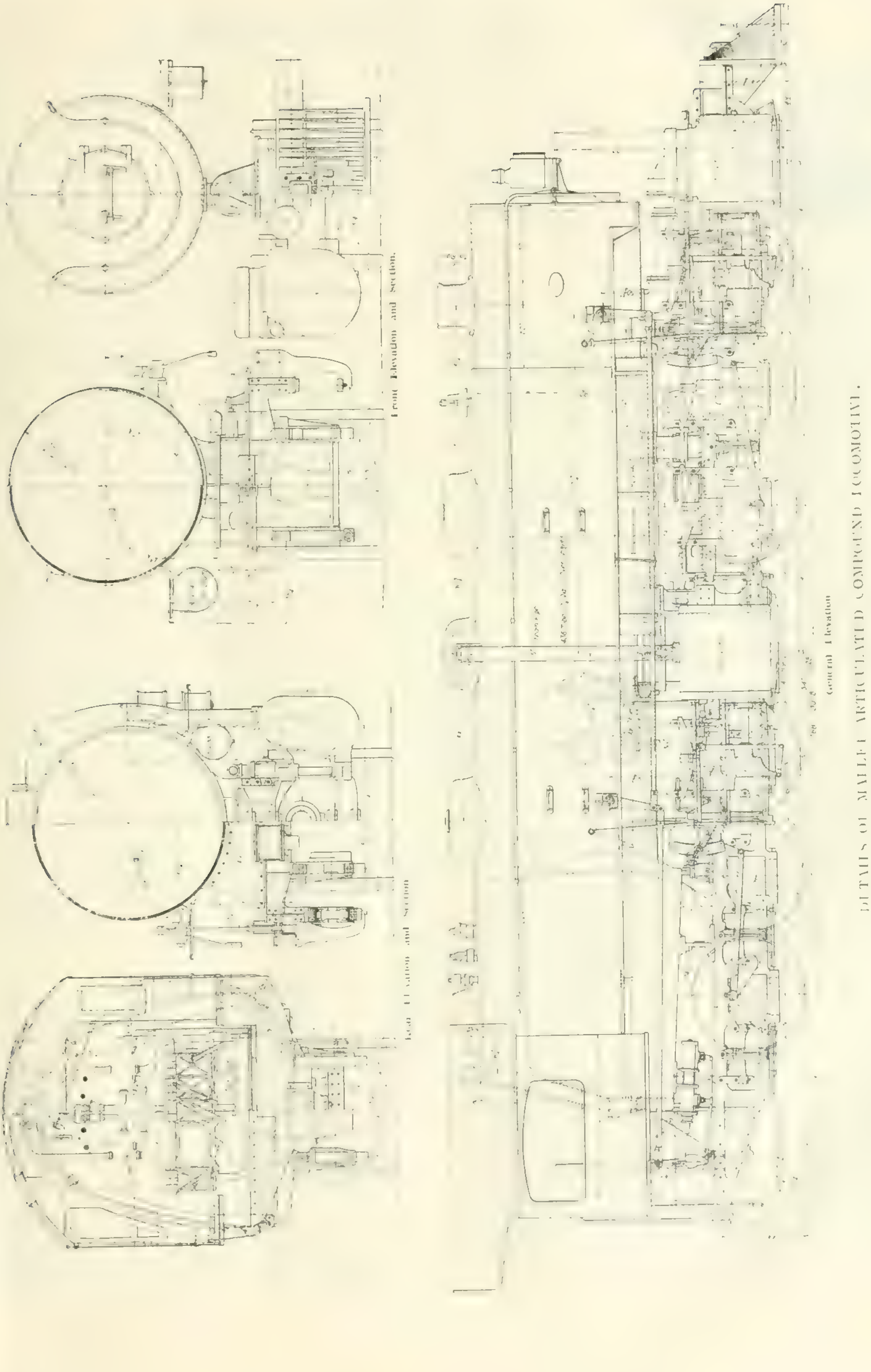


FIG. 1. MALLET ARTICULATED COMPOUND LOCOMOTIVE BY THE AMERICAN LOCOMOTIVE COMPANY, CONTRASTED WITH STEPHENSON'S "ROCKET."

MALLET ARTICULATED COMPOUND LOCOMOTIVE (B. AND O. R. R.)

BY THE AMERICAN LOCOMOTIVE COMPANY.

THIS powerful engine exerts a tractive force of over 71,000 lb. working compound and over 86,000 lb. working simple, and is designed for use in heavy pushing service on mountain grades. The Mallet system of compounding is used for steam and power distribution. While all four cylinders are outside the frame, the low and high-pressure cylinders are entirely independent of each other in respect to their movement and action on the wheels. The two high-pressure cylinders form a complete engine connected to and driving six drivers in the ordinary way. Ahead of this engine is another, also having six drivers driven by the low-pressure cylinders. This forward engine has a separate frame, connected by a hinged joint at the back to the frame to the rear engine. There are two complete sets of valve gears, cross-heads, rods, and other parts directly concerned with the engines. The steam, which is at 235 lb. pressure, after being expanded in the high-pressure cylinders, is exhausted into a receiver consisting of a large pipe having a flexible connection and reaching between the two cylinders castings, from which it is admitted into the low-pressure cylinders for further work. The Mallet system of compounding is for use only on heavy slow-speed engines where, because of the distribution of power at the driving wheels, it has proved to be very successful. Fig. 1 shows this huge locomotive in comparison with Stephenson's "Rocket." For the accompanying illustrations and the above particulars we are indebted to the Railway and Engineering Review, of Chicago. This engine was one of the most notable exhibits at the St. Louis Exhibition.



Front Elevation and Section.

Rear Elevation and Section.

General Elevation.

DETAILS OF MALLET ARTICULATED COMPOUND LOCOMOTIVE.

IRON AND STEEL NOTES.

WE hear so much about foreign competition and its dire effects that it is quite refreshing to take up a paper like that which Mr. Jos. H. Harrison, M.Inst.C.E., has just contributed to the Cleveland Institution of Engineers. Without a single word on the fiscal question, the author proceeds to consider, from a practical standpoint, whether we are trying to meet foreign competition in the manufacture of iron and steel. The paper is more or less in the nature of an indictment, and the sting is in the tail, for after an impartial consideration of what we are doing and ought to do, Mr. Harrison says emphatically: "The conservatism of the iron and steel trade of this country is the greatest barrier to progress. If any new idea likely to be useful, if workable, is brought forward, whether home-made or imported, it meets with objection in every conceivable form. Instead of giving it a lift along, everyone's foot goes down upon it. The inventive power for objections to any new idea, especially if not imported, is enormous."

The paper may very well be summed up as a plea for more perfect organisation. As Mr. Harrison says—You may put down the very finest machinery and plant of every kind to produce steel cheaply, and fail to get the results hoped for. The secret of success lies in so arranging these as to make the process of manufacture continuous from the raw materal to the finished product with the least possible waste of time, and with the least possible handling, combined with systematic management. I gather that Mr. Harrison would have us approach American ideals in a selective and discriminating spirit, and when it comes to practical reforms, he advocates in pungent language that the British engineer shall have the job—Why not, indeed?

There is, he says, no lack of first-class engineering skill in most of our iron and steel works, but there is very little opportunity to use it. The ironmaster will not venture out of the beaten track, until he has seen the same thing he wants, working under the same conditions at other works for two or three years. When at last he wakes up and finds he is all behind the times, he flies into the arms of the American or German, and spends money wholesale on new plant, whilst the British engineer, who knows far better what is wanted to suit British conditions, and could save half the cost, is a mere spectator. So much for precepts and maxims. Mr. Harrison happily does more than ask questions and proclaim theories; he provides a number of practical hints, from which I shall quote freely in the following paragraphs.

The author first casts about for the cause of our inability to make iron and steel as cheaply as can be done elsewhere. The item of labour is one cause; not that there is a deficiency of it nor is the individual quality bad, but collectively the British workmen do not do all they can to help their employer to meet foreign competition. At the same time, Mr. Harrison urges engineers and metallurgists to see to it that they are doing *their* part to utilise the forces of nature to the best advantage. He begins with the raw materials.

The ironstone is within a very few miles of their furnaces, and in some cases actually comes down from the mines to the furnaces by gravity; the size of the lumps in which it comes to the furnaces is limited only by the weight a man can lift into a tub. Why not break the stones to reasonable size, say about 8 in. cubes before calcining? This should be done at the mines, and if properly arranged would cost very little, compared with the benefits obtained in regularity and efficiency. The breaking won't make much small, but there may be a little more in the kilns, owing to the greater surface exposed to the rubbing, but it is surface which is wanted for good calcining, and a little more small ore will do far less harm in the furnace than the amount of raw and partly calcined stone now going in.

Then about the lime—it is an open question as to calcining it with the stone, or separately, but in any case it seems wrong to charge it raw, both from the point of view of economy and regularity of condition. This also should not be unloaded if larger than 6 in. cubes. It is not the furnaceman's business to break limestone, and this method is obviously irregular and inefficient. A machine at the quarry will break it for far less money, and will do it honestly, too.

The coke is perhaps not so good chemically, or mechanically, as it used to be, and by putting down coke ovens at blast furnaces there is less handling

and breakage, and consequently the coke is in better condition when it gets into the furnace. Some firms do not yet see the benefit of bringing their ovens to the furnaces, but the experience of those who have done so should be convincing.

With regard to getting the materials into the furnace, it seems to Mr. Harrison that is no use putting skip charging arrangements to our furnaces, so long as they are not worked beyond 150 to 200 tons each per day, and it has yet to be proved in this country that to scrap such furnace plants and put up entirely new ones to make 300 to 400 tons per day is the right way to make a better profit. If mechanical charging is good for the 300-ton furnace, it is good for the 150-ton furnace, provided the system is made to suit the conditions. He believes this is the opinion of a good many British ironmasters, but they do not appear to be bold enough to take the job in hand, and do it. They have only to say they want it done, and there are plenty of firms in this country who would undertake it and make a success of it. If the British engineer seriously asked to be allowed to spend one half of the money per furnace we see being spent around us under foreign supervision, he would be met with a flat refusal, if nothing worse. It is quite true a vast amount of money requires to be spent on plant, to get it in line to meet foreign competition, but the British engineer is quite equal to the occasion, if he is given the chance, and knows the best how to lay the money out to make profits. There is such a thing as "paying too much for the whistle."

Coming back to mechanical charging, he says it is a good investment to spend £3,000 on plant, to save one man on each of the three shifts. Five per cent. interest on this sum about shows the wages saved, but this is not nearly all the gain. The enormous use of labour saving devices in America is not with a view to saving wages alone, but to increasing output. A further saving by mechanical charging is the gas wasted at present each time the bell is lowered.

With regard to the tapping hole gun, this is used at only one or two works in this district, and at very few outside, so far as this country is concerned. Some have discarded it as unusable, because the men would not use it. But is this sufficient excuse for discarding a tool which enables the hole to be closed, practically without the blast off? The gun will stop the hole, whether all the metal is to be run out or not, and it is only necessary to check the blast for half a minute, at the most, just enough to get in the first clay plug, then the blast put full on again gives the gun something to ram the following plugs up against. This must be better than taking the blast off altogether for anything from 5 to 20 minutes.

The pig-casting machine has made no headway here, because of the chilling effect of the moulds, and the altering of the crystalline condition of the fracture. It would not, however, be either difficult or expensive to try some arrangement for moulding the pig-beds by a machine. This would save a good deal of manual work which, to say the least, is monotonous, and there would be some wages saved and the work done in less time. Then there is the pig-breaking machine. This is perfectly successful in reducing the cost and getting rid of a troublesome class of labour. It is not used at all on Cleveland iron, which goes away in whole pigs, but the author fails to see why it should not be a saver on this iron as well as on Hematite, which goes away in half pigs. The machine will do the work, and he believes at less cost than by hand labour, and scrap will be saved.

Furnace makes have increased of late years, but the average on Cleveland iron is still under 800 tons per week. But there is no reason why this average should not be increased at least 50 per cent. without scrapping the existing plant. Some of the local firms have shown this can be done, and there is no mystery about it. It is only a question of increasing the quantity of hot blast and materials brought together in the furnace in a given time, combined with intelligent practical management. To do this, more boiler blowing and stove power is required on the one hand, and more calcining, bunkering, and slagging power on the other, and the whole process carried out under systematic supervision. In many cases there is no need to go beyond the cost of installing the additional plant required to augment that existing, but in others the blowing engine would be found unable to work at either increased speed or pressure, owing to their light construction. In cases where an old furnace plant has been run without intelligent practical management, for say 10 or 15 years, and has been allowed to fall far below its neighbours in efficiency, Mr. Harrison does not dispute it may be the best plan to demolish it, lock, stock, and barrel, and build an entirely new plant in its place, but thinks that so long as the existing plant is in good condition, it is better to add to it, and make say 300 to 400 tons per day in two furnaces of moderate capacity, rather than in one of large capacity.

(*To be continued.*)

New Coal-Screening Plant at Kilnhurst Colliery

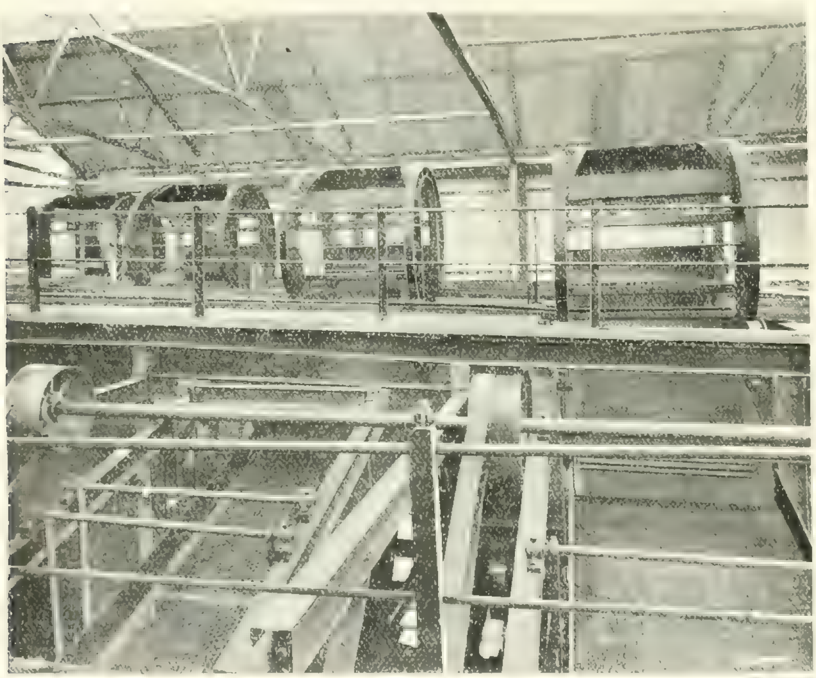
BY MESSRS. GRAHAM, MORTON & CO., LTD., LEEDS.

Capacity, 3,000 tons per day.

THE plant which is illustrated in this and the following pages has been carried out by Messrs. Graham, Morton and Co., Ltd., of Leeds, in connection with the Kilnhurst Colliery of Messrs. J. and J. Charlesworth, near Sheffield. It consists of three inclined tub-gantries, leading from two pit shafts with a screening and picking-house between.

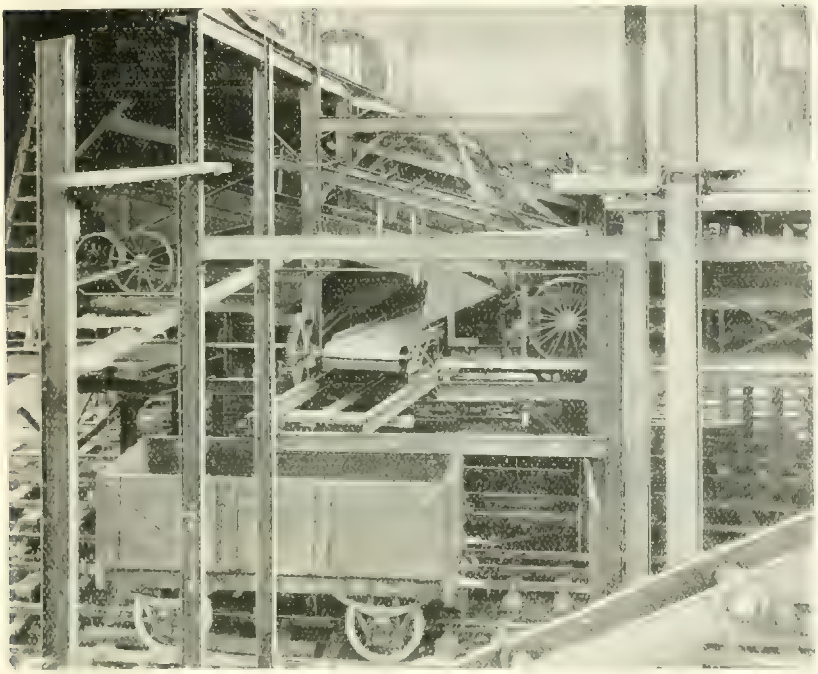
Gantry No. 1 is built of two floors, so as to deal with the tubs from the double-decked cages at the high-level pit simultaneously. The tubs, on leaving the two decks of the cages, run down by gravity to the bottom of a steep sloping gantry, and are drawn up by means of creepers which are formed of 12-in. links, securely bolted together so as to form a continuous chain, with rollers pitched every 3 ft., the attachment for engaging with the tubs being pitched 6 ft. apart. At the top they converge on one plane, where they pass over a weighing machine, which automatically records the weight of each tub. They then fall by gravitation to one of four tipplers, where their contents are discharged automatically upon revolving rollers which rotate the tippler. As the tippler turns round an automatic catch comes into action, with levers, thereby preventing the tubs from falling out. The next full tub coming along pushes the empty tub out of the tippler. The empties continue their course through the screening-house and return to the high-level pit by means of gantry No. 2, which is solely used for the return empties, and is provided with two floors to suit the double-decked cages.

Gantry No. 3 deals with the tubs from the low-level pit, having the full tubs brought the one side and the empties returned by creepers similar to those on No. 1 gantry. The tubs are directed to any of the four tipplers, and to either of the return gantries by means of an elaborate system of points and crossings operated either by hand or foot. This portion of the plant presented considerable difficulty which called for careful study, as there are two classes of tubs in use at this colliery, each having a different wheel-gauge.



TIPPLERS AND JIGGING SCREENS.

After the load has been discharged, the sides of the tipplers engage with suitable locking gear, which keep them in position until fresh tubs have run in. The contents of the tubs are discharged down shoots which feed on to a fluted roller which distributes the coal evenly over the full width of the perforated jigging screens through which it is sized. The jigging screens are arranged immediately underneath the tipplers. Two are placed in position for dealing with hard coal,



DISCHARGING END OF THE PICKING BELT.

to the eccentric straps at the other end. The shafts for driving the screens are of 4½ in. diameter, and on each shaft is keyed a 3-in. diameter cast-iron flywheel weighing 5 cwt., and provided with the necessary pedestals, collars, etc. The angle of the screens is 15 deg., and the rate of work is 100 jigs per minute.

The conveyors are of the push-plate type. Their dimensions are 42 ft. 6 in. between centres, and their width 30 in. and 24 in. respectively. One is for collecting the smudge and the riddlings from the hoppers, situated on the underside of the jigging screen, and the other for delivering the small coal into the revolving screen. Each conveyor is built up of a steel trough, with steel channels, flanges and bottom plates, the return chains being supported on a lattice-braced framework, built up from the channel runners.

Each conveyor is provided with two strands of 6 in. pitch chain of thin and thick links bolted together. To the thick links are attached the push-plates, arranged at intervals of 2 ft.; these are a ¼ in. thick, and supplied with skidder bars formed of 3-in. by ⅜ in. angles, the angle runners on the conveyors being provided with 2½-in. by $\frac{7}{16}$in. hard wood strips. In addition to the push-plate conveyors described, there is provided another, 41 ft. between centres, 12 in. broad, and built up in a similar manner to those which collect the smudge from the hoppers, and delivers the small coal into the revolving screens. This third conveyor, however, has only one strand of chain. It is at this point in its history that the coal is delivered into a revolving screen, 5 ft. 6 in. in diameter, by 11 ft. long, with a capacity of screening about 40 tons per hour of small coal.

The gearing necessary for driving the whole of the plant consists of one main driving shaft, about 25 ft. long and 5½ in. diameter. From this shaft are tapered the various drives to the picking belts, jigging screens, scraper conveyor, revolving screens, and the raising and lowering gear for the lowering arms on the ends of the picking belts. The drive to the lowering arm is

one negotiates soft coal, and the other gas coal. Each screen is 26 ft. long, by 5 ft. 6 in. wide. On the underside of each main screen there is a secondary screen, with perforated plates, their object being to separate the nuts and peas into distinctive hoppers. The screenings are collected by means of suitable receiving hoppers in position on the underside of the secondary screens, working on the self-emptying principle.

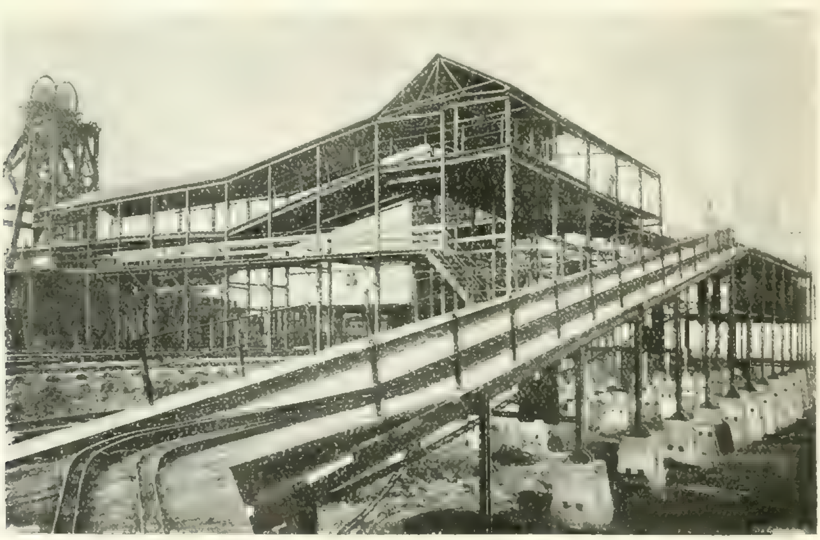
The coal passes through the first set of the jigging screens, then over the second screens hung beneath the first, where it is again screened. It is subsequently delivered by shoots, the slack on to a steel-belt conveyor, which carries it direct to the wagons, and the remainder or smallest of the coal into a special push-plate conveyor, which takes it to a revolving screen where it is again riddled, the peas being discharged into trucks and the smudge either into trucks or into another push-plate conveyor, which delivers it into an elevator. The latter, in turn, raises it to the tub gantries, whence it can be taken for firing the colliery company's boilers, etc.

The hard coal and the soft coal jigging screens are provided with two pairs of eccentrics, and straps 5-in. stroke. The gas coal screen is driven by means of a single pair of eccentrics, the eccentric rods are formed of 3-in. by ⅜-in. flat steel, forged with suitable jaws for attaching to the screens, and they are bolted

GENERAL VIEW OF STAGING.

effected by means of a $3\frac{1}{2}$-in. steel shaft, which runs the whole length of the screening-house. It is supported from the stanchions forming the side of the house by means of cast-iron brackets, the centres of which are 1 ft. 9 in. Each set of lowering gear is operated by means of 18 in. diameter wrought-iron pulleys, 18-in. face, which drive similar pulleys by open and cross belts.

The whole of the machinery is driven by a powerful horizontal steam engine, from which the main driving shaft is driven by means of double leather belting. It may afford a good idea of the magnitude of the plant which was constructed in the short space of two months, if we state that there are nine railway tracks passing through the screening house, two of these being through roads. The complete plant covers an area of 21,300 square feet. It is supported on 193 stanchions, while the total weight of the structure, independent of all machinery, is 300 tons. There are 22,876 lineal feet of 9-in. by 3-in. planking used in the flooring, and 20,180 superficial feet of corrugated sheeting used on the roof and sides. The plant dispenses with the employment a large number of hands to push the tubs about and to scrape the coal down the screens, etc.



EMPTY TUB DISCHARGE RAMP

SOME IMPRESSIONS OF AMERICAN WORKSHOPS.

By A. J. Gimson.

When in America the writer visited sixteen engineering workshops situated in cities far distant from one another, and comprising works for the manufacture of steam-engines, pumping machinery, shafting and pulleys, machine tools, elevators, and valves. Any ideas that may be here set down are of a very general character, for it was not the author's intention to inspect or investigate any special class of work.

The works visited ranged from factories at least two generations old, where generally a considerable variety of work was undertaken, to modern workshops of only a few years growth, where a special class of machine was alone manufactured. The very best of these workshops, with possibly one exception, could be matched in equipment and in general methods of carrying out work by single works in this country. Some of them were in no way in advance of ordinary practice here.

In general, however, the organisation of an engineer's workshop in America struck the author as superior to that in similar works in England, whilst in some the organisation was in every detail admirably thought out and administered.

SPECIALISTS IN MANUFACTURE.

In a modern business an American begins to make one particular machine or particular kind of machine. His whole energy is, in the first instance, concentrated upon making this machine superior to anything at the time upon the market. More than with us, he thinks that natural ability is aided by the best scientific knowledge in the design of the machine to be produced.

A feature of the engineering industry that impressed the author was the close inter-communication of technical institutes and manufacturing workshops, of professors and manufacturers, and the presence, in minor positions of authority, of young men who had passed through a complete course of technical instruction. The American employer gives one the impression of being a firm believer in the merit of the machine he is manufacturing. Doubt is eliminated from his mind, and he can enter whole-heartedly into the processes of manufacturing his particular article without a fear that it may not meet the needs of his customer. His confidence is based on a very complete knowledge of his subject, and not upon an over-exalted belief in his own special ability. When the actual making of the machine designed comes to be undertaken, it is essential that accuracy and economy of production shall be attained.

Methods were observed for obtaining accurate machine work, and methods of testing the accuracy of machines as they were being put together, which were admirable in their approach

towards perfection. No detail is too trivial to be well thought out, and the tests are such that their object is attained without needing any considerable expenditure of time on the part of the workman. Although he does not remember having seen any workmen exerting themselves more than is usual in shops here, the author is convinced more work is obtained from them through the close study of economies by the staff in the drawing and allied offices.

THE SUBDIVISION OF LABOUR.

An American employer will see that his workmen have no reason to use their time for any purpose in which they are not skilled. His foremen will do nc clerks' work. His machine men will not be grinders of tools nor designers and constructors of methods for holding and machining the work. A machine minder's business is to keep his machine moving and his tools cutting every minute of the day that is possible. It is relegated to others to design, to grind, to fetch and carry his tools, to prepare chucks, jigs and everything requisite, so that they may be ready to the workman's hand at the time they are wanted; and to his foreman is relegated the chief duty of seeing that the work is quickly and correctly done. It would be instructive to some here to know what proportion of the time of a factory's running is used by any given machine in actually performing the work it is designed to do.

The writer has seen a works where every separate job for every machine is ordered and arranged from the office staff, where every detail in the process of its machining is settled, and the number of minutes each process must occupy is displayed before the article reaches the workman's hands. In such a works a liberal bonus is paid for a saving in time, and rigorous methods are in force against those who fail to carry out the work in the stipulated time. Such methods may appear harsh, but he believes that in practice they are not so, for they are the result of accurate experience gained by an expert staff, and they recognise the enormous difference in industry and ability, that there is between different workmen.

ENGLISH AND AMERICAN WORKSHOP PRACTICE.

The able man is allowed full play for his ability, and is rewarded by a very great increase in money earned over his slower or less industrious neighbour. In the same way, by card processes, by clocks with dials divided into tenths and hundredths, are minutes saved which a workman uses in calculating his time and which a clerk wastes in complicated addition and multiplication of figures. Persistent energy and patience have achieved remarkable results in the organisation of cheap production in some of these workshops. This is the chief difference, stated in general terms, between English and American workshop practice. In this country they are somewhat wasteful of the workmen's time; in America they are careful of it to a remarkable extent. It follows that if American engineers compete successfully against English engineers, it will be, in the author's opinion, because the organisers of their businesses know their work, and carry it out better than do the organisers of businesses here. Their workmen are in no way superior but their skill and ability are used to better advantage.

In matters of design, as distinct entirely from methods of manufacture, the writer did not note great differences between American and English practice. On both sides of the Atlantic the same problems are attacked on similar lines; in details they differ, but not in principles. It would seem that there is much to be learnt from each other in these things, and that the more friendly rivalry there is between the engineers of the two nations, the better will it be for the engineering industry of the world.

Paper read before the Institution of Mechanical Engineers.

WATERWORKS PUMPING ENGINES IN THE STATES.

At the meeting of the Institute of Mechanical Engineers, held on Friday last, Mr. John Barr read a paper on this subject, of which the following is an abstract :—

The pumping stations described are Schenectady, Cincinnati, Philadelphia, Pittsburg, Chicago, St. Louis, Desmoines, Minneapolis, Winnipeg, Toronto, London (Ontario), and Boston. The author sums up the result of his observations as follows :—

The type of high-duty waterworks pumping-engine in the United States is generally that of rotary vertical triple-expansion ; this is undoubtedly the most modern type, gives best duty, and seems to be the favourite.

The steam-valves are Corliss in the high-pressure cylinder, usually Corliss in the intermediate cylinders, and poppet in the low-pressure cylinder.

Piston speed is usually about 200 ft. per minute, sometimes a little higher.

Duty under test-run varies from 140 to 160 millions of ft.-lb. per 1,000 lb. of steam, for engines having a daily capacity of from 10 to 15 millions of gallons pumped into mains against a pressure of about 100 lb. per square inch. Pumps work quite well with suction under a head of pressure, air-vessels of ample capacity and means of keeping them charged with air being provided.

Air-vessels of ample size are provided both on suction and delivery pipes. It is a common practice to have an air-vessel on top of each delivery-valve, the three air-vessels being equalised by a connecting pipe.

Pump-valves are of the multiple type of rubber or vulcanite backed by a brass or phosphor-bronze spring. Valves are about 4 in. diameter, and are very frequently set in cages placed in a strong plate in valve casing.

Centre crank-pin of large pumping-engines has one end in square block carefully fitted into slot in web of crank on one side to allow "accommodation."

Journals are almost invariably lined with "Babbett" metal.

A heater is frequently inserted in exhaust-pipe between the low-pressure cylinder and condensers. The rise in temperature thus gained by feed-water cannot be great, but is considered worth getting.

Many of these large engines are splendid examples of mechanical engineering, being smooth working, efficient, and well-finished machines.

At Minneapolis there has just been erected and set to work two sets of Holby vertical triple-expansion surface-condensing pumping engines.

Fig. 1 shows a screening arrangement at the intake from the River Mississippi in connection with the Minneapolis waterworks. The square frame at top revolves, and the screens, in the form of an endless band of rectangular sections, pass over it as they reach the top. The screens travel slowly, the water-jets spraying and washing all the time, keeping screens clean.

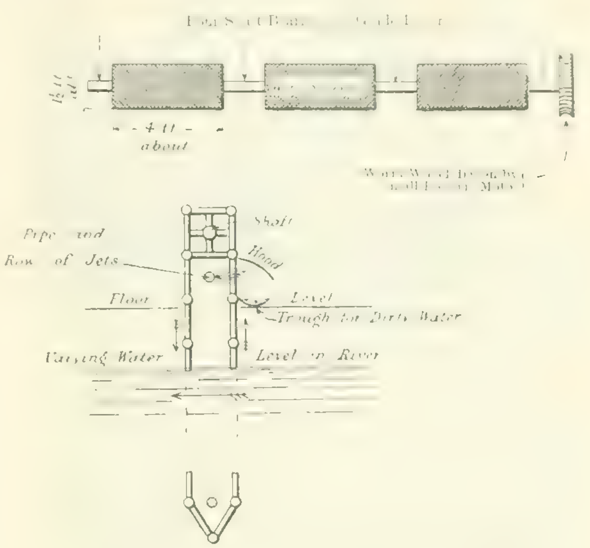


FIG. 1. REVOLVING SCREENS AT INTAKE FROM RIVER MISSISSIPPI.

In Great Britain the duty of pumping-engines is usually expressed in ft.-lb. of water lifted per 12 lb. of best Welsh coal. In the United States and Canada this duty is given as per 1,000 lb. of dry steam. In the United States the gallon employed is the "United States gallon," equal to five-sixths of the Imperial gallon. In Canada the Imperial gallon seems to be usually employed.

At the sixth ordinary general meeting of the Liverpool Engineering Society, held on Wednesday last, Mr. F. W. Steele submitted a paper entitled "Design and Work of Pressing, Stamping, Forging, and Similar Machinery." The presentation of the "Derby" gold medal and the society's premium awarded respectively to Mr. Louis J. Hunt, Assoc.M.Inst.C.E. A.M.I.E.E., and Mr. H. S. Meyer, M.Inst.I.E.E., was made at the same meeting.

ELECTRIC HEATING.

A paper on this subject was read before the Manchester Students' Section of the Institution of Electrical Engineers by Mr. Albert E. Jepson, on the 13th inst. The following is an abstract of the paper :—

The author points out that one of the chief arguments against the use of electricity for heating purposes is the great cost for actual working expenses. Before electricity can be expected to supersede coal for this purpose, it will have to be sold at slightly under 1d. per b.o.t. unit. Early types of heaters were generally composed of platinum wire resistances, until attention was afterwards directed to the use of enamels of a nature similar to that used on enamelled iron ware. The enamel proper consists of flint meal (which is composed of quartz and silicates of iron and aluminium), also tin oxide, saltpetre, ammonium-carbonate, lead sulphate, magnesium sulphate, potassium carbonate, borax, and sometimes gypsum and arsenic. These are mixed in varying proportions, very carefully selected, as too much of one chemical will make the enamel crack off, and too much of another will make the enamel melt too soon, or take too much heat to fuse on to the ground enamel while in the furnace.

One type of heating-unit made under Byng and other patents has the resistance wire crimped in a machine and then formed into the required shape, This is a wire crimped and curled just as it would be applied upon the ground enamel and after being covered with the surface enamel, connection is made to the resistance by means of the coppers attached to the ends.

Generally, cast or sheet iron is used as the base. In another type of heater for water utensils, made under Prometheus patents, very thin platinum foil of the desired shape and resistance is laid on the enamel surface and fired at a high temperature. Under another patent is also made a type of heater which is composed of strips of mica 4-1000ths of an inch thick, upon which is painted an extremely thin film of metal, generally gold or platinum. The film is sometimes only 1-4,500ths of a millimetre thick, and is quite transparent. The metals, in the form of powders, are mixed with a flux and painted on the mica and then fired in a furnace.

These films can be produced at 100,000 ohms resistance, and are usually made to consume not more than 70 watts, this being equivalent to a temperature of 450 deg. C. The films can, of course, be painted as thin and narrow as desired. When a strip of mica has a film deposited on one side, it is covered with another strip of mica and secured by a thin metal frame, which has a very small capacity for heat. When used for warming a room, these units are fixed in a metal framework which connects them in a parallel so that if one breaks down the others will continue to give out heat. In this system enamel and porcelain is used up to 250 deg. C., but beyond this temperature mica is used as the insulating base.

DIFFERENT SYSTEMS DESCRIBED.

In the Parvillée and Le Roy systems, another direction is taken altogether in the application of the heating effect. The heating units are composed of a mixture of silicates and metal, cast into bars, or of bars of agglomerate silicon. These bars of agglomerate silicon are enclosed in glass bulbs and the air exhausted. These are then fixed in frames and used as radiators or heaters. In the case of the bars of metallo-ceramic composition of the Parvillée system they can be made of any desired resistance within reasonable limits, and then brazed on to brass springs, which take up the expansion of the bars, and to which connection can be made. This metallo-ceramic compound can be made into any shape desired, which enables it to be used for many electric heating purposes.

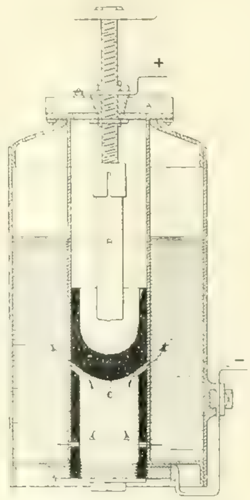


FIG. 1. SECTION OF ELECTRIC HEATER ON OUGRIMOFF SYSTEM.

In the Schindler-Jenny system the resistance, composed of wire, foil, or tape, is formed into the required shape and covered with porcelain clay, after which it is fired in a furnace, and then round the whole is cast a metallic shell of aluminium, copper, bronze, or any other suitable metal, which makes the whole a mechanically strong homogeneous mass. The units are made into various shapes, flat, with or without ribs on either or both sides, but for some types of radiators they are

cast into a circular shape with ribs on the circumference, connection to the resistance being made by three contact pins projecting through three holes in the shell.

CARBON USED AS RESISTANCE MATERIAL

In many instances, carbon is used as the resistance material as in curling irons, in which a thin pencil of carbon consuming 25 watts, is placed in the circular tongue, which is usually made of aluminium. A pencil of carbon is also used in one of the latest types of radiators, which consist of lamps about 10 in. long and 2½ in. in diameter. The contained carbon filament is about 1-16th in. in diameter, and about 13 in. long, being bent in the middle to form a single loop, each lamp consuming about 250 to 300 watts, with usually four lamps in each radiator.

Furnaces of the Borchers type also use a carbon pencil as the resistance. A small pencil of carbon 2 in. long and ⅛ in. diameter with conical ends is held in position by two very large carbon rods having conical recesses in the end of each. When a current is passed through the combination, the pencil of carbon is elevated to a white heat, fusing the mass of material which has previously been spread round it.

The following table is interesting as showing the efficiency of various sources of light :—

Efficiency of Various Sources of Light.

Source of Light.	Total Consumption of Energy in Watts required to produce a light of one Candle	Ratio of Luminous to total Radiation, or Luminous Efficiency.
Candle	86 watts	2 to 3 per cent.
Oil lamp	57 ,,	3 ,,
Petroleum lamp	42·8 ,,	3 ,,
Argand gas lamp	68·8 ,,	4 ,,
Electric glow lamp ...	3½ ,,	3 to 7 ,,
Electric arc	0·8 ,,	5 to 15 ,,
Magnesium wire		15 ,,
Electric discharge in rarefied gases		33 ,,

One of the most useful sources of heat is the electric arc, which is used extensively in many metallurgical and chemical processes. It is also used in a few domestic and similar appliances. Professor Ougrimoff, of Moscow, has designed a water heater of 98 per cent. efficiency, in which he uses the electric arc to splendid advantage (fig. 1). This heater, which can be used for many chemical processes and distilleries, consists of a crucible of cast iron in the bottom of which is placed powdered graphite. Above this crucible and regulated by a wheel and worm-screw is a large carbon rod, which is connected to the positive pole, the crucible being connected to the negative pole, so that when the arc is set up, the greater heat will be produced in the crucible. The heating chamber, chiefly consisting of the crucible, is, with the exception of the top, surrounded by the water to be heated, and when the arc is struck, the resistance of the graphite is sufficient to prevent short circuits. The arc is also used in soldering irons which are made under the Byng patents in this country. The arc is allowed to play between the carbon rod and copper bit, and heats up the latter to a temperature sufficient for use on large work. The enamel system of heating is certainly the most prominent.

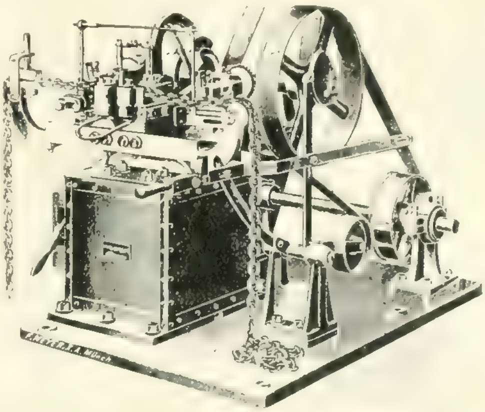


FIG. 2. ELECTRIC WELDING MACHINE.

Another type of electric heater which is well worth mentioning, and that is the electric welder (fig. 2).

The heating effect being proportional to the square of the current, by transforming a high pressure current of small amperage down to one of low pressure and high amperage, it can be used to soften or melt any metal required. From 10,000 to 40,000 amperes per square inch are generally allowed for welding purposes. This welder is an automatic one for welding the links of chains. The chain is fed in at one side with open links and leaves, the other side with the ends of each link welded. Automatic welders are made by this firm for welding bars, rings, spokes to wheels, and ornamental work on to their frames.

A welding transformer weighing 1,000 lb. is used for softening Harveyised armour plates upon which some work is required to be performed after they have been hardened and placed in position. The current is gradually raised to about 10,000, and with a surface of ½ square inch, then gradually decreased so that the portion heated shall be soft when the current is entirely switched off.

A method used for raising bars of metal to a welding temperature is to dip them into a lead-lined tank containing an aqueous solution such as potassium carbonate or borax, and the heat caused by the high resistance

film of hydrogen which is evolved at the positive pole to which the rod of iron is connected, soon raises it to a temperature sufficient to melt the metal and cause it to run off from the end of the bar.

TRAMWAY OVERHEAD EQUIPMENT.

At the meeting of the Tramways and Light Railways Association, held in the lecture room of the Society of Arts on Friday last, a paper was contributed by Mr. H. M. Sayers on this subject. With regard to the trolley wire, the author points out that its support and proper position is the principal object of the whole work. As to the best size, the conditions are too complex to lay down any general rule, but where the conditions are very severe it is better to employ one of the bronze alloys rather than a copper wire of larger size. On the subject of position of the wire in relation to track, but assuming that centre wiring is adopted, span-wire construction will be the prevailing type. The flexibility of span-wire construction greatly reduces the blow upon the ears. The soldered ear is the best form of attachment for the trolley wire. Section insulators present a combination of difficulties, and junction special-work fillings require careful attention. The cost of overhead work varies more than it should, but the author is of opinion that thoroughly good span-wire work for either double or single lines can be erected for £1,200 per route mile at a fair profit to the contractor.

RIVER HOOGHLY NAVIGATION.

At the ordinary meeting of the Institution of Civil Engineers on Tuesday, the 17th January, 1905, Sir Guilford L. Molesworth, K.C.I.E., President, in the chair, the paper read was "The River Hooghly," by Mr. L. F. Vernon-Harcourt, M.A., M.Inst.C.E. The following is an abstract of this paper :—

The River Hooghly, which provides the navigable approach to Calcutta, the capital of India, is the most western outlet of the Ganges delta. It possesses the special interest of occupying an intermediate position between tideless and tidal rivers ; for, whilst forming one of the many branches of the Ganges delta, like the branches of the tideless, deltaic Mississippi, Danube, and Nile, it flows through an expanding estuary into the sea, like the tidal Seine, Elbe, and Rhine.

On entering the estuary, there soon ceases to be any regularly defined navigable channel ; and the course selected for the buoyed channel, through a series of long, deep, pools separated by wide shoals, or bars, over which the depth is under three fathoms at the lowest low water, is merely the line which best combines the greatest available depth with stability and shelter. Various proposals have been made at different times for the improvement of the river, comprising practically all the various methods available for the purpose, namely, diversion of tributaries, diversion of the river across bends, regulation of the river by training works and training-walls, dredging, and dredging and regulation works ; but hitherto, beyond a few experimental spurs constructed in the Moyapur reach about 1866, no improvement works have been carried out.

There do not appear to be any peculiar conditions in the case of the Hooghly rendering it incapable of improvement at the worst shoals above its estuary, as has been often asserted ; and it is hoped that a careful study of the physical conditions of the river, rendered possible by the excellent charts published during the last twenty years, may lead to a satisfactory solution of the problem as to the best means of improving the river for navigation.

THE SMOKE PROBLEM.

At the monthly meeting of the Institution of Engineers and Shipbuilders in Scotland, there was an interesting discussion on Mr. E. J. Rowan's recent paper on this subject.

Mr. Andrews pointed out that the various authorities quoted by Mr. Rowan in connection with the principles of combustion did not, he thought, agree very well, except on the point that there should be a good supply of air. He did not know if any of the authorities quoted were agreed as to where the air should be admitted, and that was the very point that they knew least about in the actual stoking of furnaces. The stoker had no means of knowing how much air was admitted or how it was admitted, and with a door in front of him he just pitched in coal as the fire required it. How could they expect to get much else but black smoke under such conditions. The stoker ought to be able to take an interest in what was happening during the process of combustion, and there should be some means to enable him to see what was going on.

Mr. Gillespie thought they should concern themselves less with the smoke problem and turn their attention more in the direction of the utilisation of smoke. Smoke, of course, was gas, and that gas had been used in connection with blast-furnaces, etc. He thought it would be quite possible and economical in the case of a work where there were five or six steam boilers to put down a plant for the recovery of the tar and ammonia. The full value of the coal might be got from the recovery obtained under such a system.

STIRLING WATER-TUBE BOILER.

At the meeting of the Staffordshire Iron and Steel Institute on the 21st inst., Mr. Cyril E. Tarbolton read a paper on "The Stirling Water-Tube Boiler," with notes on the purification of feed water by the thermal system. The following is an abstract of the paper.

The author pointed out that the chief points to be aimed at in the design of generating plant are economy of working, economy in maintenance, economy in first cost, and safety. In Mr. Bryan Dawkin's work "The Heat Efficiency of Steam Boilers," it appears that while 107 tests of Lancashire boilers give an average efficiency of 62·4 per cent., the Stirling boiler shows an efficiency of 76·6 per cent., and an average of the ten tests on Stirling boilers given in table on page 204 shows 75·8 per cent. efficiency. In this connection the extremely high efficiency of the boiler fixed at the Sheffield Corporation Lighting Station should be mentioned. Roughly speaking, it may be said that with a water tube boiler, the same efficiency will be obtained as with a Lancashire boiler and economiser, while much larger units can be employed, reducing the first cost very considerably. There is also a saving in floor space with the Stirling boiler.

An ingenious mechanism for cleaning water-tube boilers is described in detail by the author. It consists of a small turbine, the rotating parts of which carry arms and cutters. The whole turbine is dropped into the tube from the upper end, and is connected by 1½ in. hose pipe with the feed pump or other water system at from 100 to 140 lb. pressure. The water having been turned on, the turbine is caused to rotate at a high rate of speed, and the tapping motion of the arms rapidly removes the scale from the tubes; while the exhaust water washes this down in advance into the lower drum.

The Stirling boiler, which is of the vertical tube type, consists essentially of three steam drums, and two mud drums, connected by four main banks or tubes. The tubes, 3¼ in. diameter, are of weldless steel, and are simply expanded into the drums. They are all bent to the same radius, being curved at each end so that they enter the drums radially.

The front and central steam drums are connected both above and below the water level, while the central and back steam drums are connected above the water level only. The two mud drums are connected together.

The three steam drums are carried by a steel framing and from them the water drums are suspended. These are kept quite clear of the side walls and foundations, so that they are free to rise and fall with the expansion of the tubes. In practice these drums drop about ¾ in. from their position when cold. Another point to be observed is that owing to the spring in the curved tubes, any tendency there may be to unequal expansion in the same bank of tubes, does not lead to leaky joints.

DETAILS OF CONSTRUCTION.

The feed water enters the boiler at the back steam drum, at a part most remote from the fire, and since there is no under-water connection with the central steam drum, its passage must necessarily be down the last bank of tubes, where it is gradually heated up, causing most of the scale to be deposited, the sediment falling into the rear water drum. The water in the front section over the fierce heat of the fire is thus left clean, and the life of the tubes greatly prolonged thereby. This arrangement of the feed enables water to be used which, under ordinary circumstances, would be quite unsuitable for tubulous boilers.

Owing to this construction the circulation is practically perfect, as the tubes are nearly vertical and each has a free outlet into the steam drums. In the horizontally inclined type of water-tube boiler, the tubes are certainly straight so far as cleaning is concerned, but considered from the point of view of circulation, the Stirling boiler has a distinct advantage, since there are no right-angle turns, due to headers, etc., that have to be negotiated.

The nearly vertical position of the tube gives an exceedingly large combustion chamber, and it may also be noted that the tubes are staggered to split up the hot gases, while all the surfaces subject to pressure are cylindrical.

The boiler is also remarkably free from any tendency to prime. A test was made by Professor Ewing on the Stirling boilers supplied to the Brompton and Kensington Electric Supply Company, in order to show the maximum evaporation that could be obtained with forced draught. This worked out at 7·4 lb. water per square foot of h.s. per hour, or nearly double the normal capacity, and the amount of moisture in the steam was only ·063 per cent.

As an example of the ease with which tubes may be scaled by the turbine cleaner, the author was recently informed by the engineer of a large steel works in Sheffield that at the end of a six months' run, three men with a turbine are able to thoroughly clean a Stirling boiler of a size equal to two 30 by 8 Lancashire boilers in one day.

Stirling boilers are also made with three steam drums and one mud drum for marine work, and for use where space is restricted; and again with two steam drums

and one road drum, for small powers. About 2½ million h.p. of Stirling boilers are now in use throughout the world.

RESULTS FROM BOILERS WORKING WITH WASTE FURNACE HEAT

	1.	2.	3.	4.
	Cornish Boiler and Tube-welding Furnace.	Stirling Boiler and Puddling Furnace.	Stirling Boiler and Puddling Furnace.	Stirling Boiler and Reheating Furnace
Duration of Test in hours	Mean of 3 1 hr trials	24	24	12·42
Heating Surface of Boiler in sq. ft.	510	1,710	1,710	1,440
Grate area of Furnace in sq. ft. ...	14	10·5	10·5	—
Ratio: Heating surface to Grate area ...	36·5 to 1	162·8 to 1	162·8 to 1	—
Total Coal used in lbs.	660	12,404	11,760	7,740
Coal used per hour in lbs. ...	660	520	491	621
Total Water evaporated in lbs. ...	1,710	93,310	94,170	46,640
Water evaporated per hour in lbs.	1,710	3,890	3,920	3,240
Water per sq. ft. of H.S. per hour	3·36	2·27	2·29	2·62
Average water per hour per lb. of Coal	2·6	7·52	8·0	6·05
Temperature of Feed in Fahrenheit	56°	139°	153°	56°
Temperature of Flue Gases in Fahrenheit	—	379°	390°	498°

No. 1 represents the results from a Cornish Boiler fired with waste heat from a Tube-welding Furnace at Great Bridge. Fuel: Large Coal.

Nos. 2 and 3.—Tests from a pair of Stirling Boilers working from Puddling Furnaces near Leeds. Fuel: Yorkshire Slack and Steam Jet draught.

No. 4.—Test from a Stirling Boiler and Steel Re-heating Furnace Fuel. Slack and Steam Jet draught.

In the thermal method of treatment described by the author, the feed water is subjected to practically the same conditions as will obtain in the boiler itself. The temperature is raised by live steam to nearly that of the water in the boiler, with the result that the carbonates and greater part of the insoluble sulphates are precipitated (where these exceed 16 gr. per gallon) just as they would be in a boiler.

By permission of Mr. J. Clifton Robinson, M.I.M.E., a visit of the Members of the Tramways and Light Railways Association to the Works of the London United Tramways has been arranged to take place early in February. The Association has already visited the power stations of the principal electric railways in London.

A SHAFT SIGNALLING DEVICE.

BY E. H. GARTHWAITE.

A paper on this subject was read before the last meeting of the Institute of Mining and Metallurgy.

The writer would like to mention a mechanical device which he came across many years ago in Mexico, and which he has since used with great satisfaction, especially in shafts 500 to 1,000 ft. deep.

The accompanying diagram shows the arrangement of this device, and it will be seen that the bell-rope from the shaft, whether vertical or inclined, winds round a drum made of wood with the sides bolted on; galvanised iron wire rope, ¼ in. in diameter, is generally used. An L shaped lever is bolted to one side of the drum, to one end of which is attaehed a rope communicating with the engine-room.

A special feature of the apparatus is the counter-weight, which consists of an iron cylinder (generally a small oil drum), which can be filled with scraps of iron, etc., so that it just counter-balances the weight of the bell-rope. This makes it possible to pull the bell-rope with but very slight exertion, so that if one is riding in a cage or bucket, at a medium speed, it is possible to give a signal to stop if necessary. The counter-weight rests on a bracket and usually a guard is placed around it so as to prevent the possibility of its tipping over.

With this device, moreover, a gong can be satisfactorily used, for overstraining is prevented by the lug A on the signal drum.

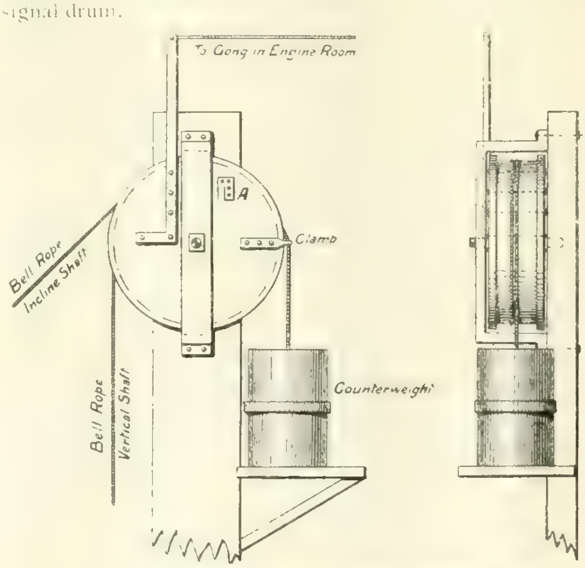


FIG. I. ARRANGEMENT OF SHAFT SIGNAL FOR 1,000 FT. OF ¼-IN. ROPE.

STREET LIGHTING BY ELECTRICAL ARC LAMPS.

At the meeting of the Glasgow Local Section of the Institution of Electrical Engineers, held at Glasgow on the 10th inst., Mr. H. B. Maxwell read a paper on this subject, of which the following is an abstract :—

The chief reason that arc lighting has not been more extensively used for street lighting is that station engineers do not charge low enough rates to make it commercially practicable, probably because they do not realise that street lighting has a load factor of over 42 per cent.

If arc lighting is adopted the following points should be considered : size and type of lamp to be used ; height of lamp from ground ; distance between lamps ; position of lamps ; whether trimming shall be with lowering gear or ladders ; whether circuits should be connected to distributors or not ; switching gear, etc., in the poles, and charge to be made per lamp per annum.

The first point to be considered is, whether open or enclosed arc should be used. The open type is much superior for street lighting, as it is much cheaper to maintain, and the colour of the light is very much better. Only five enclosed lamps can be run in series on 480 volts, as against ten open, if allowance is made for the resistance of cables, etc., and a 6-ampere enclosed lamp does not give as much light as a 10-ampere open. Enclosed lamps also do not run well in series. The author is of opinion that the 10-ampere open type arc lamp, pendant from a swan neck or bracket, in all streets will be found most satisfactory. Globes should undoubtedly be plain opalescent of such a density that the carbons are quite visible during the daytime.

The height of a 10-ampere arc from the ground level should be 20 ft., and, except in streets with very fast and heavy traffic the distance apart is not of such importance as that lamps should invariably be placed at street corners so as to get the maximum efficiency from the lamps. In main streets, where there are tramways, the lamps may be placed from 60 to 80 yards apart to suit the corners ; in less frequented streets this may be increased to 90 yards ; and in side streets to 100 yards, or even more in special cases.

The author is of opinion that it is most necessary to control the street arc circuits direct from the station by separate feeders. It is essential to have in the base of every pole at least an isolating switch and a substitutional resistance. The latter are very necessary, as without them the circuits are liable to be seriously overrun in the event of lamps failing, owing to shortness of carbon or other causes. An automatic cut-in must of course, be provided either in the lamp itself or in the base of the pole, in order to substitute the resistance when the lamp fails. The author prefers the latter position, as the cut-in is then more accessible and a third wire up the pole is unnecessary.

CAPITAL COST FIGURES.

The capital cost of installing 400 10-ampere arc lamps, with poles, resistances, cables, roadwork, switchgear, etc., will be about £24,000, so that the annual cost per annum, including all charges, will be—

	Total.	Per lamp.
7 per cent. interest, sinking fund and depreciation on £24,000	£1,680 0 0	£4 4 0
Carbons—75,000 pairs at £4 10s.	337 10 0	0 16 10½
Wages—five trimmers, repair hand, and mate	455 0 0	1 2 9
Repairs, painting, etc.	300 0 0	0 15 0
672,000 units at 1d. per unit	2,800 0 0	7 0 0
	£5,572 10 0	£13 18 7
	Say ..	13 10 0

It may be noted that charges on capital and for current will form over 80 per cent, of the total cost of the lamp if 1d. per unit is charged for current. It is therefore to these two items the author looks for any large reduction in price, although it is essential that the other items should be kept down if cheap arc lighting is required.

Seven per cent. should be allowed for interest, sinking fund, and depreciation.

The only items that should be included in the charge for current for street lighting are the works costs, exclusive of wages (which should not be increased at all by the addition of a street lighting load), and interest, sinking fund, and depreciation on the capital cost for boiler, generator, and condenser plant. The cost of all cables, feeders, and switchboards has already been debited against the capital cost of the street lighting, so that £40 per kilowatt demanded, even after providing for a small amount of spare plant, will be more than sufficient to cover the increased cost of station plant due to the street lighting. Eight per cent. interest, etc., on this sum will be a charge of £3 4s. per kilowatt per annum, which, at 3,500 units per kilowatt per annum, works out at 0·22d. per unit. Any other items, such as insurance or office costs that may be increased by the addition of street lighting, will be amply provided for by 0·03d., so that a station can supply for street lighting at the following rate : works costs— wages + 0·25d.

If considered necessary a small addition to this price may be added for profit (every 0·1d. adding £280 to the revenue from four hundred lamps), but in the author's opinion no such increase is necessary, as the decreased cost per unit of coal, stores, and repairs (especially the last item), owing to the much better load factor, will in itself cause a considerable profit. Thus, if the increased load factor reduces these costs by only a farthing, a profit of £700 will accrue from the 672,000 street-lighting units, in addition to that realised from the whole units generated from the station.

THE PARTICK SYSTEM OF STREET LIGHTING.

A description of the arrangements made in Partick is given by the author: The lamps adopted are all of the 12½-ampere open type, run ten in series on the outers of the three-wire system at 480 volts, and number in all 290, which number is shortly to be increased to 300.

The distance at which the lamps at present in use can be placed, while at the same time maintaining a good light, is surprising. In several streets the lamps are placed as far apart as 180 yards, and the result is excellent.

If in any circuit the lamps are particularly far apart, the circuit is overrun at 13 amperes, which gives a considerable increase in candle-power, or, if in others they are close together, the circuit is run at 12 amperes. This method of regulating the circuits is not generally made use of, but it is very effective, and it has been found that the extra current in no way hurts the lamps, that no special adjustment is necessary for only ½-ampere variation from the normal, and that even at 13 amperes the carbons last for more than two days even in the middle of winter.

The arc circuits are entirely run with 7–16 twin lead-covered wires laid solid, the two conductors being insulated with different coloured papers, so that they may be distinguished. The cables are looped in and out of each pole, cut and all the ends sealed in one sealing chamber. Two wires of one colour are connected into the isolating switch, the two of the other colour being joined together by a detachable connector. By this means every length of cable between poles can be tested separately.

Contiguous lamps are connected alternately on the red and white conductors, and where the ends of two circuits of ten lamps are close to each other the two circuits are connected in series, thus forming two separate single-wire circuits, with contiguous lamps on different circuits. The circuits have, as far as possible, been run in this manner, so that when a fuse blows only every alternate lamp is out till it has been replaced.

The circuits are supplied from feeder pillars, which each control from four to six circuits, in which the fuses and line resistances are placed, these being supplied from the station by independent feeders and from separate bus bars. The street lighting is started on separate machines from the ordinary supply, and afterwards paralleled on to the main bars, thus obviating any irregularity in the ordinary lighting due to switching on several circuits at once. As the machines are separated out again a dawn and shut down on the load, the feeder switches are only separated in the case of emergency, which is a great saving to the switches, as the arc formed when opening arc circuits at 500 volts is excessive owing to induction. Also if at any time an arc circuit or feeder is earthed so that a fuse will not hold, all that is necessary is to open the paralleling switch and run with one pole earthed till the fault is remedied. If the earth is on a circuit it can then be easily isolated by testing at each lamp to earth with a volt meter. This arrangement is very useful, as a negative carbon dropped through is sufficient to cause earthing on arc circuits.

To emphasise the importance of electric street lighting, it may be stated that, even in a comparatively small town like Partick, the revenue from current alone from the three hundred street lamps amounts to nearly £3,000 per annum, and in the carrying out of the scheme some £18,000 has been spent with manufacturers in this country.

The Junior Institution of Engineers recently visited the works of the Voelker Incandescent Mantle Company The works were kept specially running for the benefit of the visitors, and all the processes of manu facture were seen, under the guidance of the general manager, Mr. Clark, and the works manager, Mr. Young. They consisted of the winding of the ramie thread off the spools as received at the works, on to reels. for the weaving machines; the weaving of the thread into fabric of continuous tube formation; treatment by means of chemicals to thoroughly cleanse the fabric; cutting into lengths according to the size of mantel required; sewing on of the strengthening end piece; impregnating with thorium through small roller machines; drying; seasoning; collodionizings; trimming; and boxing. The works give employment to about 400 hands, and the total output is 30,000 mantles per day.

BRITISH TRADE PROSPECTS IN CHINA.

THE address on British commercial prospects in China, which Mr. Byron Brenan, late Consul-General at Shanghai, delivered before the Society of Arts on Tuesday afternoon, bristles with information which ought to be noted in engineering circles. Too much, he pointed out, is made of the supposed advantages to British trade arising from the opening of new Treaty ports. These new ports do not attract foreign traders, for the simple reason that the Chinese trader can undersell his European rival. The tendency in China is therefore for foreign traders to concentrate at a few centres, and this tendency will probably remain, however much China may be opened up, or the means of transportation improved. It is the volume of trade rather than its local features which concerns the British manufacturer, and in this respect there is room for immense development in China.

A POLICY FOR RAILWAY CONTRACTORS.

It is, of course, the construction of railways and the opening of mines which present the best opportunities for the employment of British capital in China. In the matter of railway construction Mr. Brenan suggests that the man who proposes the cheap and gradual method of construction has the best chance of obtaining concessions for engineering work in China. It is better to begin with a single line, light rails, wooden bridges and temporary stations, and leave the heavy expenditure to come out of the earnings of the line itself. Moreover, it is policy for a contractor to buy Chinese materials wherever he can, and it may be noted that the Belgians are buying large quantities of material from the Government iron works at Han-Yang for the line they are now constructing. On the subject of future British railways in China a good deal depends on the results achieved by the line now building from Shanghai to Nanking, and passing through the richest portion of the Empire.

THE DEMAND FOR MACHINERY.

There was a time in China when Britain dominated the commercial situation ; now it is far otherwise, our rivals are not only very numerous, but most unpleasantly alert. Hankow shows a notable example of this. The new trade is chiefly in the hands of French and German firms, and the Germans and the Belgians have secured for themselves all the Chinese contracts for machinery of every description, the local arsenals, ironworks, and mint being fitted with their manufactures. And the demand for mechanical appliances will grow, so that unless British firms are prepared to lose the trade they must educate China into a belief in British engineering work. An industry in China, capable of great developments and which is peculiarly British in character is coal mining. It is said that the coal fields of China would supply the world with coal for 3,000 years, and yet China is importing coal at a cost of a million sterling per annum. Here, then, is a field which appears to offer unlimited opportunities to the mining man and the manufacturer of coal mining machinery.

There is much else in Mr. Brenan's paper which is interesting and instructive. He shows that there are engineers even in unregenerated China ; the Chinese indeed are famous bridge builders, and the roads on the banks of rivers often give evidence of engineering skill. Mr. Brenan reveals, too, the absurdities of China's fiscal system, and the need for a change of tactics by the representatives of British industries. He believes that the present war will have a good effect on British trade with China. Sir Edward Sassoon, who presided at the lecture, dealt with the political side, but into the diagnosis of diplomatic palsy, and the question of whether British occupation of the Yangtse Valley is as effective as it should be, it is not the province of PAGE'S WEEKLY to follow him.

LAUNCHES AND TRIAL TRIPS.

TRIALS OF NEW DREDGER.

The new combined bucket and pump hopper dredger *Murihiku*, built by Messrs. Wm. Simons and Co., Ltd., of Renfrew, to the order of the Agent-General for New Zealand, has completed all her contract dredging and steaming trials with satisfactory results. At the bucket dredging trials the hopper was completely filled in twenty-five per cent. less time than stipulated by the contract, and the pumping trials were equally satisfactory. The speed trials gave a result of over 7½ knots per hour.

SELBY.

Messrs. Cochrane and Sons, shipbuilders, Selby, aunched on the 24th inst. a steel screw trawler, *Calabria*, the principal dimensions being 122 ft. by 21 ft. 9 in. by 11 ft. 3 in. depth of hold. The vessel has been built to the order of Messrs. The Grimsby Alliance Steam Fishing Company, Ltd., of Grimsby, and is being fitted with powerful triple expansion engines by Messrs. Charles D. Holmes and Co., of Hull.

LAUNCH OF A CLAN LINER.

Messrs. W. Doxford and Sons, Ltd., have just launched the large turret deck steamer *Clan Maclean* from their yard at Pallion. The vessel is built to the order of the Clan Line Steamers, Ltd. (Messrs. Cayzer, Irvine and Co.), Glasgow, and is a duplicate of several vessels already launched, and of others in hand, for the same firm. The length is 405 ft., breadth 50 ft., moulded depth 29 ft. Deadweight capacity 7,000 tons. Messrs. Doxford have supplied the engines, with cylinders 27½, 45½, and 75; stroke 54, and also the three boilers, 14 ft. 8 in. diameter, and 11 ft. 9 in. in length.

THE TYNE.

On Monday afternoon there was launched from the yard of the Northumberland Shipbuilding Company, Ltd., Howden-on-Tyne, the fine steel screw steamer, built to the order of Messrs. The Navigazione A Vapore "Napried," Ragusa, Dalmatia. The steamer is 351 ft. long by 46 ft. 10 in. beam by 27 ft. 4 in. deep., and has been constructed to a fine model with a view to rapid speed and economy in fuel. The machinery which will be supplied by the North-Eastern Marine Engineering Company, Ltd., will consist of engines with cylinders 24 in., 40 in., and 65 in., by 45 in. stroke, two large steel boilers 15 ft. 9 in. by 10 ft. 6 in., 160 lb. working pressure.

THE WEAR.

Messrs. S. P. Austin and Son, Ltd., Sunderland, launched on the 23rd inst. the steel screw steamer *Herrington*, which has been built to the order of Sir James Joicey, Bart., M.P., for the Lambton Colleries, Ltd. The vessel is designed to carry about 1,900 tons deadweight on a light draft; she has large hatchways for easy trimming, ample water ballast in cellular double bottom, and fore and after peaks for making good light passages, and other features specially adapting her for the owners' coal trade. Triple expansion machinery will be supplied by Richardsons, Westgarth and Co., Ltd.

Messrs. Wm. Pickersgill and Sons, Southwick, Sunderland, launched on the 21st inst., a finely modelled screw steamer, built to the order of Messrs. Hamilton Fraser and Co., Liverpool, this being the second ship built for them by the above firm. The vessel has a deadweight capacity of about 6,650 tons, and an exceedingly large cubic capacity. She was named *Inchborva*, and is to be engined by Messrs. Geo. Clark, Ltd., Southwick, Sunderland.

NEW PASSENGER BOAT.

The large passenger steamer *La Madona* was launched on Monday last by Swan, Hunter, and Wigham Richardson, Ltd., which is being built for the Richmond Steamship Company, Ltd. The steamer is built of steel and fitted with twin screws. She is 430 ft. in length between perpendiculars, by 48 ft. beam, and is being built to take the highest class in the Bureau Veritas Register. The accommodation for first-class passengers and a large number of emigrants is very complete, and nothing has been omitted which will tend to their comfort. The steamer is to be propelled by twin screw triple expansion engines, which are also being constructed by the builders, and are expected to give the vessel a speed of 16 knots.

HULL.

There was launched from the yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull, on the 12th inst., the *Laura* steam trawler, built to the order of Messrs. Moodys and Kelly, Grimsby, for the Fleetwood Steam Fishing Company, Ltd. Her dimensions are 126 ft. 8 in. by 22 ft. by 12 ft. 10½ in. moulded, and she will be fitted with triple expansion engines having cylinders 12¾ in., 22 in., and 36 in. diameter, by 24 in. stroke, supplied with steam from a large steel boiler working at 180 lb. per square inch.

CONTRACTORS' NEWS.

We shall be pleased to insert, under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day

Harrogate.—Supply and delivery of welded steel pipes and other materials in connection with the Masham Scheme Works; to be delivered at Ripley Station of the North-Eastern Railway. Mr. Edward Wilson Dixon, Engineer, Albert Street, Harrogate .. .. .. Jan. 28

Bradford.—Supply of steel girder, tramway rails, fishplates, steel poles. etc. Mr. Frederick Stevens, Town Clerk Jan. 28

Chertsey.—Construction of two bridges across River Wey. Mr. R. St. George-Moore, 17, Victoria Street, S.W. ... ... Jan. 30

Ebbw Vale.—Construction of Carno reservoir (three contracts). Engineer, Mr. Geo. F. Deacon, 16, Great George Street, Westminster, S.W. ... ... Jan. 31

Halifax.—Supply and erection of a coal conveyor, shutes, etc., for the Tramways and Electricity Committee. Mr. W. M. Rogerson, Borough Electrical Engineer, Foundry Street, Halifax ... ... Jan. 31

Manuden.—Erection of an iron girder bridge at Common Mead, Manuden, Essex, for the Stanstead Rural District Council. Mr. Chas. Hicks, Surveyor, Stanstead, Essex ... ... Feb. 1

London.—Supply of bearing plates for the Egyptian Delta Light Railways, Ltd., Mr. E. L. Marryat, Managing Director, 211-214, Gresham House, Old Broad Street, London, E.C.... ... ... Feb. 1

Salford.—Supply and erection of steelwork, wrought and cast-ironwork, brickwork, masonry, etc., required in the reconstruction of two bridges for the Building and Bridges Committee. Engineers, Messrs. C. S. Alliott and Son, 46, Brown Street, Manchester . Feb. 2

Handsworth.—Supply and delivery of power and lighting circuits and fittings for generating station (Contract 10), Pipework, Feed-pumps, Economiser (Contract 11), electricity meters (Contract 12). Mr. H. Ward, Clerk, Handsworth, Birmingham. Feb. 2

Kirkcaldy.—An extension of about 500 ft. to present East Pier for the Town Council. Mr. Wm. L. Macendoc, Town Clerk ... Feb. 4

Woking.—Supply and erection of steel gasholder and steel tank for the Woking District Gas Company. Mr. B. Dennett Holroyd, Secretary, 5 and 6, Great Winchester Street, E.C. ... ... Feb. 11

Nottingham.—Construction of reservoir at Wilton Hill. Mr. F. W. Davies, Water Engineer, Water Offices, St. Peter's Square Feb. 13

Todmorden.—Supply and fixing complete at their Millwood works two new purifiers, 25 ft. square, on Green's principle, with centre valves complete, for the Gas Committee. Mr. H. Hawkins, Engineer, Gasworks, Millwood, Todmorden... ... Feb. 13

Last Day

Stockport.—Overhead equipment of about four miles of electric tramway, and also supply of copper rail bonds, for the Tramways Committee. Mr. A. J. H. Carter, Borough Electrical Engineer, Millgate, Stockport . . . Feb. 16

Cape Clear.—Construction of breakwater, etc., according to plans to be seen at Coastguard Station, Baltimore. Office of Public Works, Dublin ... . Feb. 17

Bury (Lancs.)—Cutting and refilling track and laying and jointing 10,500 lineal yards of 12 in. diameter cast-iron pipes from Gin Hall reservoir, near Bury, to Whitfield, and other relative works, for the Bury and District Joint Water Board. Mr. J. Cartwright, Civil Engineer, Peel Chambers, Bury . ... Feb. 18

South Shields.—Execution of works and supply of plant in connection with the construction of overhead electric tramways. Mr. J. Moore Hayton, Town Clerk. Feb. 20

Brisbane.—Supply of steel rails and steel fishplates. Agent-General for Queensland 1, Victoria Street, S.W. ... ... Mar. 7

Lulea (Sweden).—Widening and deepening of the Channel, "Tjufholssundet," at Lulea. Harbour Commissioners, Lulea, will supply particulars ... ... April 1

Bermuda.—The Crown Agents for the Colonies are prepared, on behalf of the Government of Bermuda, to receive tenders for the deepening, widening and buoying of the channel leading from sea into St. George's Harbour, in the Islands of Bermuda. Particulars of Messrs. Coode, Son and Matthews. 9, Victoria Street, S.W. Tenders to Crown Agents for Colonies, Whitehall Gardens, S.W. ... —

Manchester.—Supply of new or sound second-hand portable 18-in. gauge railway, with metal sleepers, fish-plates, bolts, turn-out switches, etc.; also wagons of half to three-quarter yard capacity, for the Manchester Corporation. Appy to Mr. T. de Courcy Meade, City Surveyor, Town Hall, Manchester. ... ... —

COMING CONTRACTS.

New Zealand.—The Wellington and Auckland electric tramways are to be extended. At Wellington the amount to be expended is about £77,000. It has not yet been decided whether the work will be carried out by contract.

Newcastle-on-Tyne.—The Tramways Committee have decided to instruct the city engineer to prepare plans for the extension of the tramways.

Yarmouth.—Application is to be made by the Corporation for a loan of £10,000 for new plant, including another 300-kilowatt engine and dynamo and boilers, at £4,500, and an additional water conduit, estimated to cost £3,500. The Corporation is about to expend £56,000 on electric tramways.

Anstruther.—Amended plans by Mr. Henderson, Edinburgh, for the proposed harbour extension at Anstruther, were submitted at the monthly meeting of the Harbour Board. The estimated cost of the extension has been increased to £36,704.

Windermere.—It has been decided to place orders for a number of additional motor cars on the Windermere-Keswick route.

Norwich.—Application is to be made for loans of £30,000 for the purposes of the electricity undertaking to September 30, 1907.

Kirkcaldy.—It is stated that the Town Council have received sanction to borrow £30,000 for works connected with the electric supply undertaking.

Brooklyn Bridge (N.Y.).—The engineers have recommended the adoption of plans entailing the virtual reconstruction of the bridge, and the cost is roughly estimated at £1,000,000.

Knaresborough. — The Harrogate Corporation engineer, Mr. E. W. Dixon, has been retained to examine the plans of the District Council for a drainage scheme for Pannal, estimated to cost £20,000.

CONTRACTS CLOSED.

Fife.—Graham, Morton and Co., Ltd., have just installed a new conveying plant at Michael Colliery, Fife, for the Wemyss Coal Company.

Japan.—Robert Stephenson and Co., Ltd., Darlington, have received an order for eighteen locomotives for the Imperial Railways of Japan.

Leeds.—The Corporation have placed an order for 850 tons of steel tramway rails with Walter Scott, Ltd.

Edinburgh.—An order has been placed with the Whessoe Foundry Company, Ltd., Darlington, for gas purifiers.

United States Government. — William Johnson and Sons (Leeds), Ltd., have received an order from the U.S.A. Government for one of their coal briquette plants as the result of their exhibit at the recent World's Fair.

Chippenham.—The tender of Mr. E. Ireland, of Morecambe, has been accepted for sewage and sewage disposal works at the sum of £11,550.

Belfast.—Messrs. Harland and Wolff, of Belfast, have obtained an order from the owners of the Bibby Line for a new 8,000 tons steamer, a sister ship to the *Worcestershire*. The new vessel is to be named the *Herefordshire*.

Cradley Heath.—Messrs. Richard Sykes and Son, Ltd., of Cradley Heath, have obtained a large foreign order for the supply of cable and other chains.

London.—The Brush Electrical Engineering Co., Ltd., have secured the following contracts: Four cars complete with B.T.H. motors for Colne and Trawden Light Railways, through Greenwood and Batley; four 60-k.w. transformers, four 25-k.w. transformers, through Midland Electric Corporation, for Power Distribution, Ltd.; thirty-four carbodies: one car complete with Radial Action Truck, and Raworth's Regenerative Control Equipment for the West Ham Corporation.

Burma.—Lobnitz and Co., Ltd., Renfrew, have received an order for gold-dredging machinery for Burma, which is to be built under the direction of Messrs. Burt and Kirkcaldy.

Whitby.—The Urban District Council have accepted the tender of Messrs. C. A. Parsons and Co. for a 200-k.w. steam turbine.

Rotherham.—Messrs. S. Dixon and Son, Ltd, of Leeds, have received an order from the Rotherham Corporation Tramways Department for the installation of Turner's automatic point controller.

APPOINTMENTS VACANT.

	Last Day
Ashton-under-Lyne.—Temporary employment as electrical engineer. Mr. G. H. Partington, Poor Law Office, Ashton-under-Lyne ...	Jan. 31
East Indian Railway.—Assistant locomotive superintendent. Salary Rs. 350 rising to Rs. 400 per calendar month. Mr. C. W. Young, Secretary, 28, Nicholas Lane, E.C.	Feb. 11
India Office.—Assistant engineers in the permanent establishment of the Indian Public Works' Department. Secretary, Public Department, India Office, Whitehall, S.W.	May 1

APPOINTMENTS FILLED.

Chesterfield.—The Town Council has decided to appoint Mr. R. L. Acland, electrical engineer, to the joint offices of electrical engineer and manager of the Tramways Department at an initial salary of £350 per annum.

Walthamstow.—Mr. Fooks Bale, of Birkenhead, has been appointed electrical engineer and tramways manager to the Walthamstow Urban District Council at a salary of £400 a year.

Ramsgate.—Mr. M. Farrer has resigned the position of chief assistant to the Twickenham and Teddington Electric Supply Company, Ltd., to take up the position of resident engineer to the Ramsgate and District Electric Supply Company, Ltd.

Singapore.—Mr. Lewis D. Landay, has been appointed general manager of the Singapore Electrical Tramways Company. This company, which has a capital of £650,000, will commence its operations in April next.

Chester.—Mr. Percy Heard has been appointed to the position of superintendent at the Chester Corporation electricity works.

Battersea.—Mr. W. A. Kemm, chief assistant electrical engineer, has been recommended for appointment as chief electrical engineer to the Borough of Battersea at an initial salary of £350 per annum.

Engineering Standards Committee. — Mr. James C. Inglis, General Manager of the Great Western Railway, has been nominated by the Council of the Institution of Civil Engineers as one of their representatives on the Engineering Standards Committee, in the place of the late Mr. John Allen McDonald, Engineer-in-Chief of the Midland Railway.

Midland Railway.—The Directors of the Midland Railway have appointed Mr. John Elliot to the position of superintendent of the line, in succession to Mr. T. Eaton. Mr. Elliot was formerly passenger agent at St. Pancras, and on the decentralisation of the superintendent's department in October, 1901, he was appointed London district superintendent. He became outdoor assistant superintendent of the line on January 1st, 1903.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS. Settling days on the Stock Exchange are as follows:—
Consols: February 1st. General Settlements: January 27th, February 10th, 24th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
11,270	5	5%	Alldays & Onions Pneumatic Engineering, Ltd. ..	3	2¼— 3
10,000	5	3	Do. Cum. Pref. 6 per cent. ..	5	4½ 5
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3¼ 3½
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅝— 5⅞
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½	Aveling and Porter, Ltd., 4½%, Reg Mt Debs Red. ..	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord. ..	1	3½ - 3⅝
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref. ..	5	5 — 5½
250,000	1	6½d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1¼
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8	Barrow Hæmatite Steel Co., Ld., O.	4½	[illegible]
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4¼ 4¾
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares ..	5	4¼ 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd		100 —102
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	98 —100
149,850	1	6d.	Bengal Iron and Steel Ord.	1	1 — 1½
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible]
300,000	1	6½d.	Do. 5½% Cum Pref.	1	1⅜— [illegible]
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	94 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 - 1⅛
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1¼ 1[illegible]
590,000	1	6d.	Do. Ord., Nos. 1,160 001-1,750,000	1	[illegible]
74,000	10	5/-	Do. 5% Cum. Pref. .	10	11 — 11¼
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	[illegible]
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	[illegible]
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible]
70,000	5	2/6	Do. 5% Cum. Pref.	5	[illegible]
£250,000	Stk	4%	Do 4% 1st Mort Db. Stk. Red	100	100 —102
100,000	10	30/-	Consett Iron Co., Ltd., Ord. .	7½	33 35
57,000	10	10/-	Crossley, Bros, Ld, Ord. 40340/97370	10	16 16½
40,339	10	5/-	Do. 5% Cum Pref .. .	10	11 11½
75,000	1	2/6	Delta Metal, Ltd. Shares ..	1	1¾ 2
1,259,594	1	3d.	Dorman, Long & Co., Ltd.	1	[illegible]
£400,000	Stk	4	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90 93
£250,000	Stk		Do. 6% 2nd Mort. Deb Stk, Red.		94 96
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating ..	5	[illegible]
250,000	1	9d.	Dunlop (James) & Co., Ltd., Ord. ..	1	[illegible]
300,000	1	7½d	Do. 6% Cum. Pref.	1	[illegible] 1
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9 10
69,754	13	12/-	Do. do. do.	10	7 8½
20,000	10	8/-	Elliott's Metal, Ltd.	8	[illegible]
5,000	10	5	Do. Cum. Pref. 5%	10	[illegible]
186,748	Stk	4	Do. Deb. 4 . .	100	93 98
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10½— 11
£250,000	Stk	4½	Do. 4½% Mort. Deb. Stk. Red.	100	97 —100
9,000	10	10	Fleming & Ferguson, Ltd. Ord Nos. 1/9000	10	12 12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9 9½
14,000	3	3	Fraser & Chalmers, Ltd., Ord ..	3	[illegible]
24,000	3	1/6	Do. 7½% Cum. Pref.	3	[illegible]
10,000	10	.	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4	Do 4% 1st Mort. Deb Red. .	100	[illegible]
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 2
344,000	5	2/6	Do. 5% Cum. Pref. ..	5	5½ 6½
£1,850,500	Stk	4	Do. 4% Perp. Mort. Deb. Stk.	100	105 —107
1,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 3
250,000	1	1/-	Hadfield's Steel F'dry Co, Ld., Ord.	1	[illegible]
20,000	10	4/6	Do. 4½% Cum. Pref. ..	10	10 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref. ..	5	[illegible]
408,000	1	1/6	Harvey United Steel Co., Ltd.	1	1 1
17,500	10	7½	Hawthorn, Leslie & Co., Ltd. Ord.	10	11 —11½
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	[illegible]
85,000	1	7½d.	Hill (Richard) & Co. (1893) Ld., Ord.	1	[illegible]
18,000	5	3/-	Do. 6% Cum. Pref. . ..	5	4 5
40,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	[illegible]

ENGINEERING, IRON, AND STEEL COMPANIES. *Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	[illegible]
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) .	10	12¼ 12¾
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	[illegible]
37,500	10	20	Kynoch, Ltd.	10	19 — 20
49,537	10	5%	Do. Cum. Pref. 5% .. .	10	10 11
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝— ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾ 4¼
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 1[illegible]
£300,000	Stk	4½%	Do. 4½ 1st Mt Deb. Stk, Red.	100	108 110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 — 11½
210,000	1	6d.	Measures Bros., Ltd, Ord.	1	[illegible]
75,000	1	6½d.	Do. 5½ Cum. Pref. .	1	[illegible]
£75,000	Stk	4½	Do. 4½% 1st Mrt. Db. Stk., Red.	100	96 99
21,943	5	2/6	Muntz Metal, Ltd.	5	5 [illegible]
14,248	5	5%	Do. Pref 5% ..	5	5⅛ [illegible]
6,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	74 76
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	11¾— 12
80,000	5		North-Eastern Steel Co., Ltd., Ord.	5	
£250,000	Stk	4½	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3¾ - 4
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5 [illegible]
70,000	10	6/-	Pease & Partners, Ltd., Ord. .	10	10— 10½
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4½ 5
65,000	1		Pooley (Henry) & Son., Ltd., Ord ..	1	3/- —4/-
13,000	5		Do. 5½ Cum Pref. .. .	5	2¾ 3
230,000	1		Projectile Co. (1902), Ltd., Ord. ..	1	[illegible]
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1¾ - 2
73,062	5	2/-	Do. New	5	[illegible]
£330,000		5%	Do. 5% Mort. Deb., Red. ..	100	99 —102
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	[illegible]
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	95 97
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	[illegible]
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	[illegible] 1
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1 — 1[illegible]
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red ..	100	90 — 93
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	
300,000	1	7½d	Do. 6% Cum. Pref. ..	1	[illegible]
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	[illegible]
49,560	10	2½	Steel Co. of Scotland Ord. 1/49560. .	9	[illegible]
£125,240	Stk		Do. 5% Trust Mort. Deb. ..	100	[illegible]
25,000	10		Stephenson (Robert) & Co., Ltd., Or.	10	[illegible]
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	[illegible]
£250,000	Stk	4	Do. 4% Perp. Deb. Stock	100	76 78
85,000	10	9	Stewarts & Lloyds, Ltd., Ord. .	10	17 17½
55,000	10	6/-	Do. 6% Cum. Pref .. .	10	14 14½
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	[illegible] 1
538,845	1	6d.	Do. 5% Cum. Pref.	1	1
£240,000	Stk	4½	Do. 4½% 1st Mort. Deb Stk Red	100	97 — 100
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	[illegible]
£200,000	100	4	Do. 4% Irredeem. 1st Mort. Deb.	100	67 70
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	[illegible] 1
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½— 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	[illegible]
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	[illegible]
[illegible]	$1000	[illegible]	Do. 10-60 Yrs. 5% Sk. Fd. G. Bds	$1000	[illegible] 97
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord. .	1	[illegible]
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1 1[illegible]
£750,000	Stk	5	Do. 5% Non-Cum. Pref. Stock.	100	114 —117
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	105 — 107
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	[illegible]
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	[illegible]
£390,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	[illegible]
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref 5½	5	[illegible]
300	Stk	4½	Do. Mort. Deb. 4½%	100	91 97
60,000	5	3	Wilson & Robinson, Ord. ..	5	[illegible]
60,000	5	3/-	Do. 6% Cum. Pref.	5	3 — 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	74 [illegible]
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	80 — 85

Stocks and Shares marked * are quoted ex dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Divi dend.	Name	Paid up	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16 — 9/16
120,000	1	9d.	Bell's Asbestos Co., Ltd.	1	11/16 — 13/16
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5 — 5¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¼ — 5¾
£500,000	Stk	4½	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. .	100	101 —103
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2⅝ — 2⅞
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red..	100	86 — 88
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½ — ¾
150,000	2	2/4	Do. 6% Pref.	2	1¼ — 1½
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk..	100	93 — 96
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	74 — 77
35,000	5	5	Callender's Cable & Constn. Ltd. Ord.	5	9 — 10
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅝
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	104 —106
85,000	3	1/6	Crompton & Co., Ltd...	3	2 — 2¼
£100,000	-	5%	Do. 5% 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8 — 8½
61,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ — 6
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	105 —108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261 ..	3	⅝ — ⅞
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1½
£341,023	Stk	4%	Do. 4% Deb. Stock Red. .	100	78 — 83
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1⅛ — 1¼
31,390	2	2/9½	Do. 7% Cumulative Pref. ..	2	2¼ — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99*
10,248	10	7/6	Evered and Co., Ltd...	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10½ — 11
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5⅛ — 5⅝
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	110 —112
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15 — 16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 —102
7,500	10		Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/- —16/6
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	38 — 40
£150,000	100	4%	Do. 4% Deb. Bonds	100	101½-103½

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Divi-dend.	Name.	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼ — 8½
260,007	5	2/6	Do. 5% Cum Pf.	5	5 9/16 — 5 11/16
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	12 — 12½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 —102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	95 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	11/16 — 13/16
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	⅞ — 1
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1½ — 2
75,000	5	2/6	Do. 5% Cum. Pf.	5	3¼ — 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 —98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock .. .	100	100 —103
		%	Pref. Ord. Stock .. .	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¾ — 10¼
156,437	10	6/-	Do. 6% Cum. Pref...	10	11⅛ — 11⅜
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	118 —120
£250,000	Stk	4%	Do. 4% 2nd Deb. Stk. Red..	100	97 — 99
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	4 — 4¼
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5¾ — 6⅛
27,000	5	3/-	Do. "B" do.	5	5¼ — 5⅝
£200,000	Stk	5	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	94 — 97

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Divi dend	Name	Paid up.	Closing Prices
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	99 —102
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8⅜ — 8⅞
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅜ — 1⅝*
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ — 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —104
155,000	5	4/-	City of Buenos Ayres Trams. Co., Ld.	5	10¼ — 10½
£116,000	Stk	6%	Do. Per. 6% Deb. Stk...	100	140 —145
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½ — 14½
59,987	10	6/-	Do. 6% Pref...	10	15½ — 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3½ — 4
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10½ — 10
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 —106
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 —103
314,016	1		Metropolitan Elec. Trams, Ltd., Def.	1	⅜ — ½
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	⅞ — 1⅛
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	103 —105
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,923	8	2/9	North Metropolitan Tramways Co..	8	4¾ — 5¼
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	101 —104
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½ — 9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 —102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Divi-dend	Name	Paid up	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12 — 12½
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½ — 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	103 —105
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½ — 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord .	5	8½ — 8¾
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8¼ — 8¾
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅜ — 5⅝
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	101 —103
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¾ — 7¼
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 —110
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O	10	11½ — 12
40,000	10	6/-	Do. 6% Cum. Pref. .. .	10	13½ — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red .	100	121 —125
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	101 —103
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	107 —110
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord	5	6¼ — 6½*
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108*
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd 5% Deb. Stk. Red.	100	86 — 91
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5½ — 6
£50,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red	100	102 —105
15,000	10		Havana Electricity Co., Ltd .. .	10	9½ — 10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—102
150,000	1		Kalgoorlie Electric Power & Lighting Corp. Ltd., 6% Cum. Pref.	1	⅜ — 11/16
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12¾ — 13¼

Stocks and Shares marked * are quoted ex-dividend

ELECTRIC LIGHTING AND POWER. *Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£135,000	Stk	4 %	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	—	London Elec. Supply Corp., Ld., Ord.	3	2¼ — 2¾
60,000	5	3/-	Do. 6% Pref.	5	5[illegible] — 5[illegible]
£371,895	Stk	4 %	Do. 4% 1st Mort. Db. Stk., Red	100	96 — 98
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	17[illegible] — 18¼
76,121	5	2/3	Do. 4½ Cum. Pref.	5	5¼ — 5¾
220,000	Stk	4½ %	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½ %	Do. 3½% Mort. Deb. Stk., Red.	100	96 — 98
£250,000		4½%	Midland Elec. Corp. for Power Distribution Ld., 4½% 1st Mort. Deb.	100	92 — 95
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 — 104
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6½ — 6[illegible]
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 — 100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13[illegible] — 14¼
20,000	5	3/6	Do. 7% Pref.	5	8[illegible] — 9
£150,000	Stk	3½ %	Do. 3½% Deben Stock, Red	100	98 — 100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾ — 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd., O.	5	4½ — 4¾
100,000	1	-	South Metropolitan Elec. Light & Power Co., Ltd. Ord.	1	[illegible] — 1
50,000	1	8½d.	Do. 7% Cum. Pref.	1	1[illegible] — 1[illegible]
£100,000	Stk	4½ %	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5½
30,000	5	2/6	Do. 5% Cum Pref.	5	5[illegible] — 5[illegible]
£200,000	Stk		Do. 4½% 1st Mort. Deb Stk. Red	100	105 — 107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	13 — 13½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼ — 6[illegible]

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£34,800	100	4 %	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10		Amazon Telegraph Co., Ld... ..	10	[illegible] — 1[illegible]
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	55 — 57
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary	100	101 — 103
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	10¾ — 11
14,000	5	3/-	Chili Telephone Co., Ltd.	5	6½ — 6[illegible]
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 — 190
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	95 — 97
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8[illegible] — 9[illegible]
6,000	10	10/-	Do. 10% Preference	10	16½ — 17½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3[illegible] — 3[illegible]
		5/-	10% Cum. Preference	5	7[illegible] — 8[illegible]
£30,000	50	4½ %	Do. 4½% Debs...	50	100-102
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	10[illegible] — 10[illegible]
£85,800	100	4½ %	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 — 101
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	101 —103
£200,000	25	4 %	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100-102%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13[illegible] — 14
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 — 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	134 — 137
£2,000,000	Stk	17/6	Do. 3½% Pref.	100	87 — 89
£1,836,814	Stk	4%	Do. 4% Mort. Deb. ..	100	105 — 107
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	29 — 29¼
£58,700	100	4½ %	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99 — 101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	45 — 47
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	[illegible] — [illegible]
£1,983,333	Stk	6 %	National Telephone Co., Ltd., Pref.	100	108 — 109
£1,966,667	Stk	5%	Do. Deferred	100	108 — 110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5[illegible] — 5[illegible]
£2,000,000	Stk	3½ %	Do. 3½% Deb. Stk., Red. ..	100	96 — 98
£[illegible]	Stk	4 %	Do. 4% do. do. ..	100	101 — 103
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 — 1⅛
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1½ — 1½
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	96 — 99
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7 — 7½
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6½ — 6[illegible]
10,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5 %	Do. 5% Deb. Stock, Red. ..	100	104—106
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	7¼ — 7[illegible]
£30,008	2½	-	West Coast of America, Ltd. ..	2½	½ — [illegible]
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	98 — 100

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	[illegible] — [illegible]
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	7½ — 7¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6[illegible] — 7¼
£80,000	100	5%	Do. 5% Deb.	100	101 — 103
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½ — 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 — 103
518,945	Stk	4%	Do. 4% Deb. Stock, Red.	100	100½—102½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½ — 9
£325,000	Stk	4½ %	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½ %	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk.. Red.	100	91 — 93
10,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 6½
£600,000	Stk	4½ %	Do. 4½% 1st Mort. Deb. Stk.	100	73 — 76
£750,000	Stk	4½ %	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 — 100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13 — 13½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5¾ — 6¼
£464,430	Stk	4½ %	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ — 1¼
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4½ — 4¾
36,758	8	4/9½	Do. Non-Cum. 6% Pref.	8	7¼ — 7¾
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	97 — 99
55,000	5	1/3	Houlder Line, Ltd., Ord. ..	5	3 — 3½
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼ — 3[illegible]
£200,000	Stk	4½ %	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
111,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4¾ — 5
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126 —129
£1,160,000	Stk	19 %	Do. do. Deferred ..	100	217 — 220
15,000	100	30/-	Royal Mail Steam Packet Co. Ord.	60	26 — 27
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4[illegible] — 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8 — 8½
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	9¼ — 10¼
£1,008,894	Stk	4 %	Do. 4% Debenture Stk., Red.	100	99 —101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up	Closing Prices.
60,000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	[illegible] — 1¼
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	138 —143
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf..	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	[illegible] — [illegible]
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	[illegible] — [illegible]
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1[illegible] — 1[illegible]
135,000	1	7⅛d.	Do. 6% Cum. Pref.	1	1[illegible] — 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

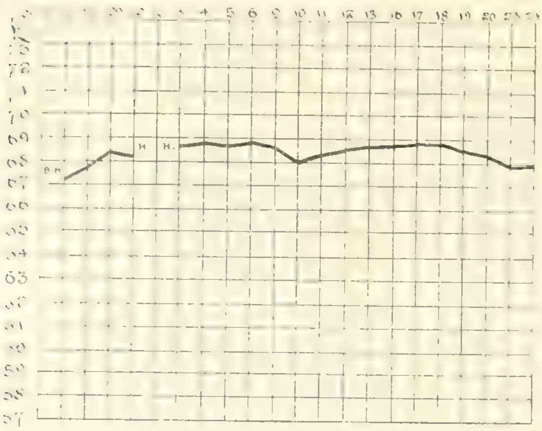
Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	21 — 21½
8,739	10	3/-	Do. Second Issue 1-8,739 .	1	[illegible] — [illegible]
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 — 13[illegible]
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 — 9½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4[illegible]
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	39/6 — 39/9
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6 — 24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/9 — 28/3
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 — 20
10,000	20	7½d.	Do. Pref. 6 per cent. 1-10,000		22[illegible] — 22[illegible]

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM DECEMBER 27TH, 1904, TO JANUARY 24TH, 1905.

COPPER.



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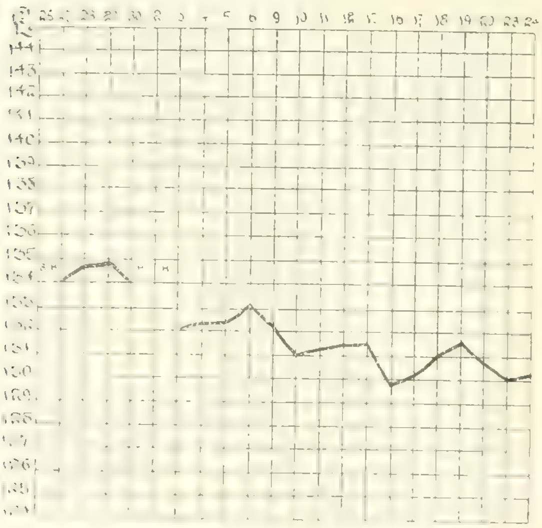
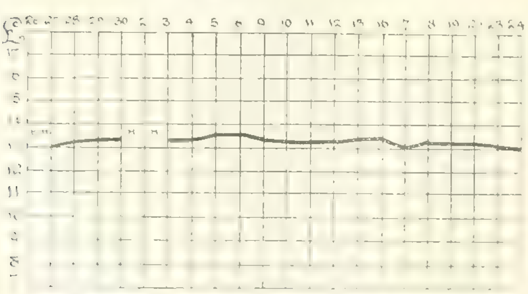


ENGLISH LEAD.



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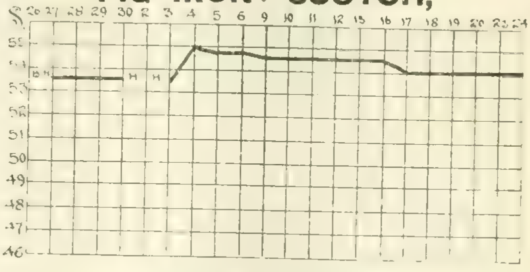

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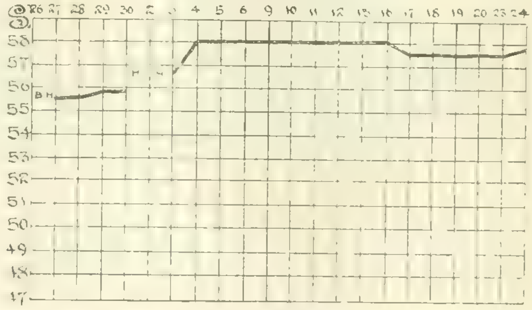
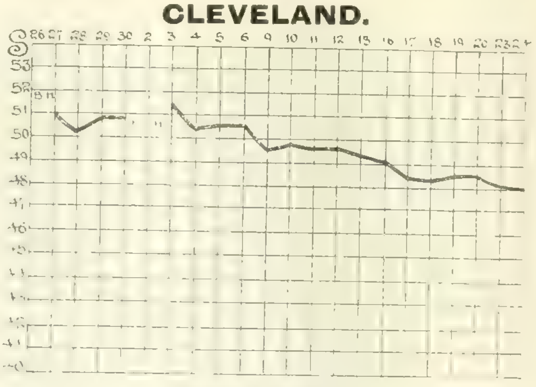
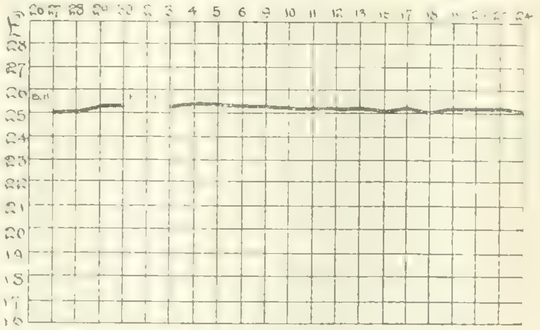


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, January 25th, 1905.

THE copper market has been in the grip of speculative influences, and the frequent changes in quotations have been rather due to efforts to manipulate the market, than to fresh developments in connection with the position of the metal itself. Reference was made last week to the bare condition of the market, and it is difficult to see what is to stop the rise in quotations. In view of the increased trade activity in the United States, it is anticipated the consumption will reach 20,000 tons per month against 16,000 tons last year, while the European consumption is also increasing. Surplus stocks in the States are already exhausted, and those held in England and France represent no more than three weeks' consumption. The copper market is therefore trading on the smallest margin; and the scarcity of the metal appears likely to continue. The Amalgamated Company has again raised the price of electro, but our market yesterday closed rather easier.

Tin has been quiet, and lower Eastern advices assisted the efforts of dealers to depress the market pending the Banca sale. Three months' tin at one time was sold down to £129 15s., but the latest prices are better, best Foreign at £130 5s. cash, and £130 three months.

Lead is easier in tendency, the large arrivals checking the tendency towards the rise in quotations which has manifested itself more than once latterly. The close yesterday was £12 13s. 6d. Foreign, and £12 17s. 6d. English.

Spelter has had a temporary slight set-back, speculators for the rise finding an unwilling market when it came to realisations. This, however, was a mere phase and a recovery quickly followed. Consumers still have to deal with a depleted market.

In the Iron and Steel sections the Glasgow market has exhibited considerable activity. There has been a swerve in quotations due to the weeding out of the weak bull element, but speculative support was soon forthcoming, and the market once more hardened, although the latest tendency is again towards flatness. Outside the speculative market, the reports from trade centres point to improving business, particularly in shipbuilding materials and other heavy lines.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

	£	s.	d.
Steel:			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
,, ,, ,, Ship ,,	6	7	6
,, ,, Angles	5	7	6
Manufactured Iron:			
Bars Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow Steel)	5	8	9	per ton.
Steel Ship Plates (Glasgow Steel)	5	18	9	,,
Steel Bars, Ship Quality (Glasgow Steel)	6	8	9	,,
Steel Bars, Boiler Quality (Glasgow Steel)	6	18	9	,,
Steel Land Boiler Plates (Glasgow Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix			
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra)

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	5	0	2	15	0
Gartsherrie ,,	2	19	6	2	14	6
Summerlee ,,	3	0	6	2	15	0
Carnbroe ,,	2	17	6	2	14	0
Langloan ,,	3	4	0	2	16	0
Calder ,,	2	19	0	2	14	6
Clyde ,,	2	19	0	2	14	6
Glengarnock, f.o.b. Ardrossan	2	19	0	2	13	6
Eglinton ,, ,,	2	15	6	2	13	0
Dalmellington, ,, Ayr	2	15	6	2	13	0
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote :—

	Iron. £	s	d.	Steel. £	s.	d.
Crown (BNF) Bars	6	10	0	7	0	0
,, ,, Angles	7	0	0	7	10	0
,, ,, Tees	7	10	0	8	0	0
,, (WIW) Hoops	7	0	0	7	10	0
,, ,, Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote :—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in. per ton. £	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	7	6	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	15	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote :—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
,, ,, Best Best	9	5	0	,,
,, ,, Treble	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	6
C 28 by 20 112s. 216 ,, "Lydbrook"	1	5	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	13	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d.	
Steel:					
Blooms	at	3	12	0	per ton.
Billets	at	3	14	0	,,
Sheet Bars	at	3	16	0	,,
Finished Steel:					
Bars	at	4	17	6	per ton.
Angles	at	4	18	6	,,
Tees	at	5	2	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	4	0	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	5	0	,,
Heavy Rails	at	4	10	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis 1¼ % & 1 %	131	0	0	to	131	10	0	per ton
English Bars, f.o.b. Dis. 1¼ % & 1 %	132	0	0	to	132	10	0	,,
Straits G.M.B., cash Warehouse, Net	130	0	0	to	130	5	0	,,
Straits G.M.B., 3 months, Warehouse, Net	129	15	0	to	130	0	0	,,
Australian, Mr. Bischoff, Warehouse, Net	130	15	0	to	131	0	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	67	15	0	to	68	0	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	67	15	0	to	68	0	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	10	0	to	71	0	0	,,
English, Best Select, Warehouse Net	71	10	0	to	72	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½ %	80	0	0	to	80	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½ %	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½ %	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	15	0	to	25	0		per ton
Blende of 50 %, Net	7	0	0	to	7	10		,,
Calamine, Net	7	2	6	to	7	12		,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½ %	13	0	0	to	13	2	6	per ton.
Spanish, ex ship, Dis. 2½ %	12	15	0	to	12	17	6	,,
Lead Ore of 70 %, Net	6	12	6	to	6	15	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	36	10	0	to	37	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½ %	8	0	0	to	9	0	0	,,
Crude, ex ship, Dis. 2½ %	13	10	0	to	14	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	15	0	per flask.
Italian	7	14	0	

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, [illegible] to 2 in. cube	5	6

STEAM — TOP HARD.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric ... at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	15	0	per ton.
Grey ,,	11	0	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
Sal-ammoniac, Lump, 1sts, del[d.] U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate ... f.o.b. Liverpool	13	2	6	,,
Arsenic: Best White Powdered ... net	12	0	0	,,
Bleaching Powder, 35% ... ,,	4	10	0	,,
Borax: British Refined Crystal ... ,,	12	0	0	,,

Coal Tar Products:

	£	s.	d.	
Benzole, 50/90% ,,	0	0	8¼	per gal.
,, 90% ,,	0	0	10	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	6⅞	per lb.
,, ,, ,, 39/40° C. ... ,,	0	0	7⅛	,,
,, ,, Liquid, 97/99% ... ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	2	0	,,
Creosote, ordinary good liquid ... ,,	0	0	1¼	,,
Naphtha, Crude, 20% at 120° C. ... ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b. ,,	0	0	8½	,,
,, ,, 95% at 160° C. ,, ,,	0	0	9½	,,
,, ,, 90% at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. ... f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. ... f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch ... f.a.s. Manchester. ,,	1	12	0	per ton.
Copperas: Green, in bulk ... ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ... ,,	1	2	6	,,
Copper: Sulphate	23	0	0	,,
Cyanides: 98% minimum ... f.o.b. net	0	0	8	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	24	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	16	10	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England...	0	0	3	per lb.
Carbonate, 90/92% ... c.i.f Hull ...	18	0	0	per ton.
Caustic, 75/80% ... ,, ,, ...	20	10	0	,,
Chlorate ... net	0	0	$3\frac{1}{16}$	per lb.
Montreal ... in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow ... net	0	0	$4\frac{15}{16}$	per lb.

	£	s.	d.	
Soda: Ash, Caustic, 48 %, Ordinary ... ,,	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 %............ ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 %.............. ,,	10	10	0	,,
,, ,, 70 %.............. ,,	9	12	6	,,
,, ,, 60 %.. .... ,,	8	12	6	,,
,, Cream, 60 %..... .... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	10	0	,,
Bicarbonate, in 1 cwt. kegs	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
Nitrate ..ex quay Liverpool, ... ,,	11	0	0	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	3⅝	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)................	1	12	6	,,
,, (Saltcake, 95 %)...............	1	15	0	,,
Sulphur: Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers..................................	7	10	0	,,
Zinc: Sulphate	6	15	0	,,

MINERALS.

	£	s.	d.	
Barytes: Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,
China Clay: of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore: Basis 50% c.i.f. British Ports...........	3	7	6	,,
Manganese: Lump c.i.f. Liverpool 10¼d. per metallic unit.				
Ochre: French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc: (French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

	£	s.	d	
Aniline Oil ....net	0	0	4⅞	per lb.
,, **Salt**	0	0	4½	,,
Castor Oil: French, 1st pressure, f.o.b. Marseilles less 1½%.........	23	0	0	per ton.
English, 1st pressure, f.o.r. Hull, less 2½% ...	24	0	0	,,
Cocoa Nut Oil: Ceylon, ex store Manchester...............net	29	10	0	,,
Cochin, ex store Manchester .... net	32	0	0	,,
Cotton Seed Oil: Refined at Hull, less 2½%, naked	12	15	0	,,
Edible...at Hull, less 2½% naked	13	5	0	,,
Glycerine: Crude, 80% .... net	31	0	0	,,
Linseed Oil: Raw... ..at Hull, less 2½% naked	12	15	0	,,
Boiled......at Hull less 2½% naked	13	15	0	,,
Starch: American Pearl...at Manchester, net	9	0	0	,,
Dextrine............ ,, ,,	18	0	0	,,
Farina............... ,, ,,	15	15	0	,,
Shellac: Standard TN orange spot	150/-			per cwt.
Turpentine: American.........at Liverpool	38	10	0	per ton.
Russian ....at Hull...net	18	10	0	

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	3		0	3	3
Lower Ports Pine	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	3
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	0		0	3	9
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks......................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine ..	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	10	0		6	15	0
Lower Ports Spruce..	,,	6	0	0		6	10	0
Spruce Boards.......	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	3	to	0	1	8
Sawn	,,	0	0	10		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak...............	per load	12	0	0		15	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	9	to	0	2	3
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	2		0	1	4
Riga Whitewood	,,	0	1	3		0	1	6
Norway Mining Timber	,,	0	0	9		0	0	10
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std	19	0	0		21	0	0
Red Archangel and Onega, 2nd quality	,,	16	0	0		17	0	0
Red Archangel and Onega, 3rd quality	,,	12	10	0		15	0	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	14	0	0		17	10	0
Wyburg	,,	12	0	0		13	10	0
Uleaborg	,,	12	0	0		13	10	0
Gothenburg	,,	14	0	0		17	10	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

6. W. Cochrane, London. Jan. 2nd.—Improvements in and relating to the propulsion and manœuvring of boats and ships, including those of the submarine type.

19. H. S. Booth, Manchester. Jan. 2nd.—Improvements in motors.

26. R. H. Elkins, London. Jan. 2nd.—Improvements in lubricating machines.

30. J. M. Hewitt, Manchester. Jan. 2nd.—Improvements in pumps.

31. H. C. Braun, London. Jan. 2nd.—Improvements in liquid measuring machines.

41. C. W. Beissel, Hull. Jan. 2nd.—Improvements in oil separators.

50. P. Thielmann and J. Meisenburg, Germany. Jan. 2nd.—Apparatus for making frames for mine cages and the like.

55. J. Farnsworth, Notts. Jan. 2nd.—An improvement in paddle-wheel propeller for ships.

57. C. Barclay, Liverpool. Jan. 2nd.—Improvements in internal combustion engines.

61. T. Holland, Belfast. Jan. 2nd.—Double-rake automatic saw bench.

63. J. Mitchell, Cardiff. Jan. 2nd.—Improvements in or relating to double volute springs for wagon buffers and draw springs.

67. Fried. Krupp Akt.-Ges., London. Jan. 2nd.—Improvements in or connected with valve operating mechanism for motive power engines. (Date applied for April 11th, 1904.)

71. J. H. Broadwood, London. Jan. 2nd.—Improvements in and relating to couplings for railway and like vehicles.

78. S. A. Bhisey, London. Jan. 2nd.—New or improved levigating or pulping machine or apparatus.

93. J. B. Williams, London. Jan. 2nd.—Improvements in machines for bagging and weighing grain.

101. A. H. C. Gibson, Birmingham. Jan. 3rd.—Apparatus and means for examining and gauging the conditions within the cylinders or other parts of mechanisms of any description, which mechanisms are concerned in the utilisation or development of pressure, or in the use of the expansive qualities of liquids or gases under pressure.

103. W. Dyer, Bournemouth. Jan. 3rd.—An improvement in couplings for railway trucks and the like.

108. A. Musker, Liverpool. Jan. 3rd.—Improvements in presses.

116. W. H. B. Maulkin, Keighley. Jan. 3rd.—Improvements appertaining to brake mechanism for railway vehicles.

123. W. L. Wise, London. Jan. 3rd.—Improvements in apparatus for and process of electric welding and other metal working operations. (*The Thomson Electric Welding Company, U.S.A.*)

130. A. E. Tomkins, London. Jan. 3rd.—Improvements in and connected with clutches for conveying rotary motion.

141. K. Pohl, Germany. Jan. 3rd.—Improvements in rope, cord, and belt driving.

142. W. Hanke, Germany. Jan. 3rd.—Improvements in and relating to safety devices for machines with belt driving and disengaging gear.

146. O. Rost, Germany. Jan. 3rd.—A machine for automatically making screw taps.

147. J. Martin, London. Jan. 3rd.—Improvements in apparatus for coating vessels.

149. W. H. Lomas, London. Jan. 3rd.—Improvements in apparatus for the separation of liquids from solids more especially intended for use in the treatment of metalliferous ores.

152. E. A. Richardson, London. Jan. 3rd.—Automatic block signalling system for railways. (Date applied for July 25th, 1904.)

166. J. M. Butler and B. Williams, Leeds. Jan. 4th.—Tidal power generator and elevator.

199. C. Hegans, London. Jan. 4th.—Improvements in or relating to locomotives.

200. T. L. Sturtevant and T. J. Sturtevant, London. Jan. 4th.—Power transmitting mechanism.

201. T. L. Sturtevant and T. J. Sturtevant, London. Jan. 4th.—Power transmitting mechanism.

216. G. W. Bell and F. M. Hale, London. Jan. 4th.—Improvements in torpedoes.

217. W. H. Wheatley, London. Jan. 4th.—Improvements in pneumatic tools. (*The Hudson Machine and Pneumatic Tool Company, U.S.A.*)

227. B. E. Scriven and W. C. Smith, Manchester. Jan. 5th.—Improvements in mechanical variable transmission gear.

262. R. A. Hadfield, London. Jan. 5th.—Improvements relating to projectiles with driving bands.

271. W. West, Birmingham. Jan. 6th.—Lock nuts applicable to bolts, screw pins and the like.

289. W. T. Ellison, Manchester. Jan. 6th.—Improvements in and relating to superheaters.

293. T. F. Walker and T. S. Walker, London. Jan. 6th.—Improvements in and relating to ship's logs.

306. T. Carlyle, Ltd., and W. McLean, Birmingham. Jan. 6th.—An improved safety device for power presses.

307. The Westinghouse Brake Company, Ltd., and W. Rendell, London. Jan. 6th.—Improvements relating to fluid pressure brakes.

309. W. G. Mein, London. Jan. 7.—Improvements in and relating to bearings.

325. R. A. Griffiths, Handsworth. Jan. 7th.—Improvements in gas or oil engines.

340. A. Anderson, Dumbarton, Scotland. Jan. 7th.—Sensitive equalising valves for hydraulic pumping apparatus.

341. W. G. Heys, Manchester. Jan. 7th.—A new or improved thermostat. (*A. Goldstein, C. F. Patterson, R. L. McElroy, and J. F. Shepherd, U.S.A.*)

355. A. Harris and F. A. Anderson, London. Jan. 7th.—Improvements in and relating to surface condensors.

359. E. Allen and Co., Ltd., Sheffield. Jan. 7th.—Improvements in and relating to automatic coupling buffers for railway trucks and other vehicles. (*W. McIlwaine Robinson and E. E. Litchfield, Transvaal.*)

364. W. Lewis, London. Jan. 7th.—Improvements relating to machine saws.

371. A. P. Filipi, London. Jan. 7th.—Improvements in propellers. (Date applied for Jan. 6th, 1904.)

372. H. van Meerten, London. Jan. 7th.—Improvements in or pertaining to turbines.

373. G. Buhler, London. Jan. 7th.—Improvements in pulley blocks. (Date applied for Jan. 6th, 1904.)

289. D. Hunter, Manchester. Jan. 9th.—Improved clinker pit in connection with boiler and other furnaces.

394. A. J. Howcroft, Uppermill. Jan. 9th.—Simple expansion locomotive engine with steam cut-off arrangement.

397. W. I. Twombly, London. Jan. 9th.—Improvements in process for forming steam.

419. Coln-Musener Bergwerks-Actien Verein, London. Jan. 9th.—Improved method of avoiding of filling up blow-holes and like flaws in casting. (Date applied for Jan 11th, 1904.)

440. A. Latham, Birmingham. Jan. 10th.—Improvements in piston rings.

441. L. Delaney, Bradford. Jan. 10th.—Improvements in the setting or supports of stationary steam boilers for facilitating the inspection thereof.

442. A. J. Bailey, Manchester. Jan. 10th.—Improvements in valves for steam and other fluids.

454. J. Page, Reliance Engineering Company, Woodley. Jan. 10th.—Improvements in steam traps.

461. T. C. Philipson, Hull. Jan. 10th.—Improvements in scavenging automobile gas, oil and other explosive vapour engines.

463. B. S. Aslakson, London. Jan. 10th.—Improvements in apparatus for converting heat derived from fire into energy for utilisation.

467. J. K. Broadbent and S. T. Richardson, Manchester. Jan. 10th.—Improvements in and relating to the furnaces of steam generators and the like.

503. H. Techel and M. Salaschek, London. Jan. 10th.—Improvements relating to valve gear for internal combustion engines. Date applied for Jan. 15th, 1904.

507. A. W. French, London. Jan. 10th.—Improvements in valves for hydraulic presses.

511. H. Donner, London. Jan. 10th.—Improvements in or relating to engines or motors.

RECENT SPECIFICATIONS.

STEAM TURBINES.

The Hon. Charles A. Parsons, and G. G. Stoney, of Newcastle-on-Tyne. Dec. 30th, 1903.—Relates to improvements in the method of blading elastic fluid turbines, turbine pumps and the like, described in Patents Nos. 10940 of 1901, 5697 of 1897, 8698 of 1898, 11284 of 1899, and 2317 of 1901, and has for its object to facilitate the manufacture of such apparatus, and to provide for the holding of the strip blades more securely and with greater accuracy of

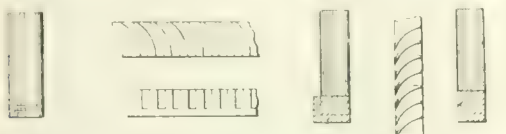


Fig. 1. Fig. 2. Fig. 2a. Fig. 3.

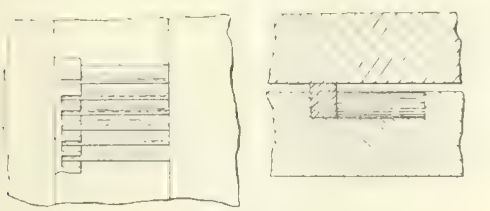


Fig. 4.

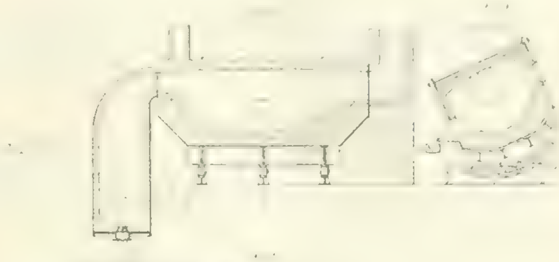
Fig. 5.

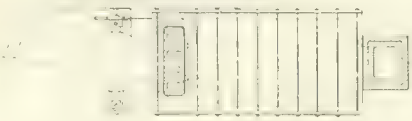
Fig. 6.

position. The invention consists in a method of manufacturing bladed root strips for steam turbines comprising (1) the cutting of transverse face grooves in the metal root strip; (2) the insertion of the blades into these grooves from the face; (3) the placing of the strip with its blades in a groove die adapted to retain the blades and strip in their relative positions; (4) the application of great lateral pressure so as to grip the blades in the strip and close up the air spaces, thus providing a blade carrying strip ready for attachment in any of the usual ways to the turbine drum or disc. The invention further consists in the construction of the blade rings by an improved method.

METALS AND ALLOYS.

Charles Cammell and Co., Ltd., J. E. Fletcher, and W. B. Hamilton, of Sheffield. Dec. 28th, 1903.—Refers particularly to the manufacture of steel. According to this invention the whole of the iron is melted in the heating furnace supplementing the waste heat from the converter by the combustion of some gas such as producer gas which is comparatively free from sulphur. By this means a continuous and rapid delivery of charges of steel of any grade is produced by first melting down iron in an open-hearth heating furnace. When this iron is molten, and if desired, slightly decarburised or otherwise refined, it is run directly into the converter and is there further decarburised as required by the well-known Bessemer, Robert, Tropenas, or other similar methods. The waste gases produced in the Bessemer





converter are passed, in conjunction with producer gas and air, into the open-hearth heating furnace, thus producing sufficient heat to melt iron (and, if necessary, partially decarburise, desulphurise, or otherwise refine the same) rapidly enough to feed the converter after the completion of each charge of melt of steel.

LOCOMOTIVE BRAKES.

The Westinghouse Brake Company, Ltd., London (communication from the Westinghouse Air Brake Company, of Pittsburg, U.S.A.). Jan. 19th, 1904.—Relates to fluid pressure brakes, and more particularly to devices for maintaining, in spite of leakage, the desired pressures in the train pipe and brake cylinders, respectively, of an automatic air-brake system while the brake remains applied. The objects of the invention are to provide improved means for supplying fluid under pressure to the train pipe while the brakes are applied, with the brake valve in lap position, whereby all leakage from the train pipe is compensated for and the pressure is maintained constant at the required degree of reduction for any length of time desired, and also having thus assured the maintenance of the desired pressure in the train pipe, to insure that the brake cylinder pressure shall also be maintained and any reduction therein, due to leakage, be automatically supplied from the train pipe. In this invention use is made of the well-known equalising principle as applied to the driver's brake valve for controlling the pressure of fluid

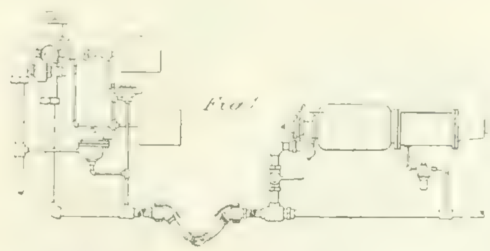


Fig. 1.

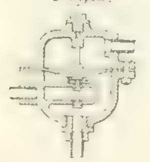


Fig. 2.

Fig. 3.

in the regulating chamber of the apparatus. To maintain the brake cylinder pressure as mentioned above, despite leakage, a cylinder feed-valve device governed by brake cylinder pressure is employed for controlling communication between the train pipe and the brake cylinder. For maintaining a desired pressure in the train pipe, while the brakes remain applied, the pressure in a regulating chamber which controls the operation of the feed valve, governing communication between the main reservoir and the train pipe, is equalised with that to which the train pipe is reduced at the time of making the application of the brakes by means of an equalising device in the driver's brake valve.

NEW PUBLICATIONS.

"THE ROYAL NAVY LIST"

And Naval Recorder: a book of reference relating to the personnel of the Navy, both active and retired, and the ships of the Fleet; together with a narrative of contemporary naval events, and a naval bibliography. No. 104. January, 1905. Witherby and Co. 10s.

The commanding position in public interest to which the Royal Navy has attained during recent years has made it essential that the scope of this well-known reference book should be considerably extended; the result is that the present issue makes quite a portentious volume. In addition to the regular features, we note that it is now possible not only to trace the careers of the officers, but also the history of the ships. Particularly interesting is the new section devoted to a bibliography of naval literature; although at present this is not so extensive as could be desired, we have no doubt that in subsequent issues the list will be judicicusly augmented; in a catalogue of this description, the titles of many of the papers read before the Institution of Naval Architects might be included with advantage. The cover of the volume is capable of improvement; a stronger binding would make the work more serviceable, and worthy of a permanent place in the reference library. Altogether, however, the editors are to be congratulated upon the comprehensiveness of their production.

"THE THEORY OF ELECTROLYTIC DISSOCIATION."

A Short Introduction, by J. C. Gregory, B. Sc., A.I.C. Longmans, Green and Co. 1s. 6d.

Students anxious to acquire a knowledge of the modern theory of electrolytic dissociation are recommended to secure a copy of Mr. Gregory's lucidly written treatise. The writer divides his subject into, the conditions of dissolved substances; ions and precipitation; the hydrogen and hydroxyl ions, and some electrolytic and general considerations.

"MAXWELL'S THEORY AND WIRELESS TELEGRAPHY."

Part I., "Maxwell's Theory and Hertzian Oscillations," by H. Poincaré; translated by Frederick K. Vreeland. Part II., "The Principles of Wireless Telegraphy," by Frederick K. Vreeland. Archibald Constable. 10s. 6d. net.

The author informs us that the aim of this work is to give a physical treatment of Maxwell's theory and its applications to some modern electrical problems, to demonstrate the fundamental principles which underlie all electrical phenomena, according to Maxwell and his followers, to show how these principles explain the ordinary facts of electricity and optics, and to derive from them a practical understanding of the essentials of wireless telegraphy.

Part I. deals successively with generalisations regarding electrical phenomena; Maxwell's theory; electrical oscillations before Hertz; Hertz's oscillator; methods of observation; propagation along a wire; measurement of wave-length and multiple resonance; propagation in air; propagation in dielectrics; production of very rapid oscillations; imitation of optical phenomena, and synthesis of light. Part II., for which Mr. Vreeland is responsible, opens with a discussion of the general principles of wireless telegraphy; this is followed by, telegraphy by Hertzian waves; the grounded oscillator; propagation of grounded waves; the receiving apparatus; and selective signalling. The work is profusely illustrated with useful diagrams.

NEW CATALOGUES.

Messrs Everett, Edgcumbe and Co., of 151, and 152, Great Saffron Hill, Holborn Circus E.C., have displayed considerable ingenuity in drawing attention to their electrical measuring instruments. Their folding card has an excellent representation of two hands enforcing the words, "It's just like this!" and contains the firm's offer to forward their price list.

A 1905 Edition of their illustrated catalogue of Iron Buildings Roofs, Bridges, and General Constructional Work in Steel and Iron, has been issued by Messrs. Brownlie and Murray, Ltd., of Possil Iron Works, Glasgow. Most of the illustrations have been taken from work designed and erected by the firm, and they are intended to show the many uses for which iron and steel may be utilised with advantage in buildings of all descriptions.

Messrs. Mather and Platt, Ltd., of Salford Iron Works, Manchester, have issued a second edition of their catalogue of Polyphase Generators.

Messrs. Holden and Brooke, Ltd., forward leaflets giving extracts from letters of users of Brooke's 1903 Patent Steam Trap, and Patent "P.S." (Protected Seat) Valve.

"Stevedore" Plumbago laid Manila Rope, manufactured solely for transmission of power and hoisting cargo, is described and illustrated in a four page leaflet issued by the C. W. Hunt Company. We note that this rope is made four strand with a heart.

Matthews and Yates, Ltd., of Swinton, Manchester, have issued a pamphlet describing the "Cyclone" High speed (Enclosed type) Forced Lubrication Engine. This engine is specially designed for driving fans and dynamos, and it is claimed that it is entirely self-contained, and is of the smallest possible dimensions compatible with ease in adjusting and cleaning, and the economical performance of the work it has to do.

From Mr. Eric S. A. Smith, of Bridlington, we have received a number of pamphlets and leaflets relating to Hydraulic Rams and Ram Pumps; "Climax" Steel Windmills for power and pumping purposes; Smith's American Incandescent Vapor Gas Lamps and Supplies; the "Handy Man" Oil Engine; the "Perfection" Direct Copying System"; the "Khoma" Gas Arc Lamp; and illustrations of high-fall single and double suction turbines, low fall turbines, etc.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, JAN. 27th. — Institution of Civil Engineers, Great George Street, Westminster, S.W.—Students Meeting, 8 p.m.: Paper, "Concrete-Making on the Admiralty Harbour Works, Dover," by Mr. T. L. Matthews.—Engineering Society: University College, London. 5 p.m.; Paper, "The Barrage of the Thames," by Mr. B. B. Willcox.—Royal Institution, Albemarle Street, W., 8 p.m.: Lecture by Dr. Wilson. — Electrical Engineers, Ball at Hotel Cecil, Strand, London.—Physical Society Meeting at the Royal College of Science, Exhibition Road, South Kensington, 5 p.m.: Papers, "Action of a Magnetic Field on the Discharge through a Gas,' by Dr. Willows "Action of Radium on the Electric Spark," by Dr. Willows and Mr. J. Peck. "The Slow Stretch in Indiarubber, Glass and Metal Wires when subjected to a Constant Pull," by Mr. P Phillips. "Determination of Young's Modulus for Glass, by Mr. C. A. Bell. "Some Methods for Studying the Viscosity of Solids," by Dr. Boris Weinberg.

SATURDAY, JAN. 28th.—Manchester Association of Engineers, Grand Hotel, 7 p.m.: "Multiple Effect Evaporation," Mr. Chas. Day

MONDAY, JAN. 30—Society of Arts, 8 p.m.: Cantor Lecture, "Reservoir Fountain and Stylographic Pens," Lecture 2, by Mr. James P. Maginnis.

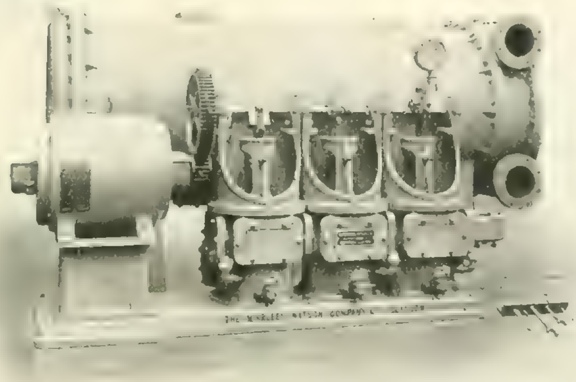
TUESDAY, JAN. 31.—University of Liverpool Engineering Society, 5.30 p.m.: Paper, "Electrical Transmission," by Mr. G. W. Worrall.—Institution of Electrical Engineers (Manchester Local Section), 8 p.m.: Paper, "Some Points in the Selection of Electric Cables," by Messrs. L. B. Atkinson and C. J. Beaver.

WEDNESDAY, FEB. 1.—Geological Society of London, 8 p.m.—Society of Arts, 8 p.m.: Ordinary Meeting.

THURSDAY, FEB. 2.—Chemical Society.—Civil and Mechanical Engineers' Society, Caxton Hall, Westminster, 8 p.m.: Paper, "The Mechanics of Flour Milling," by Mr A. R. Tattersall.—Royal Society Meeting, 4.30 p.m.—Royal Institution, 5 p.m

FRIDAY, FEB. 3.—Royal Society, 9 p.m.: Lecture by Professor T. Clifford Allbut.—Geologists' Association: Annual General Meeting, University College, Gower Street, 7.30 p.m.—Junior Institute of Engineers, Westminster Palace Hotel, 8 p.m.: Paper, "Recent Developments in Electric Lighting," by Professor H. T. Davidge.

PAGE'S WEEKLY Miscellaneous



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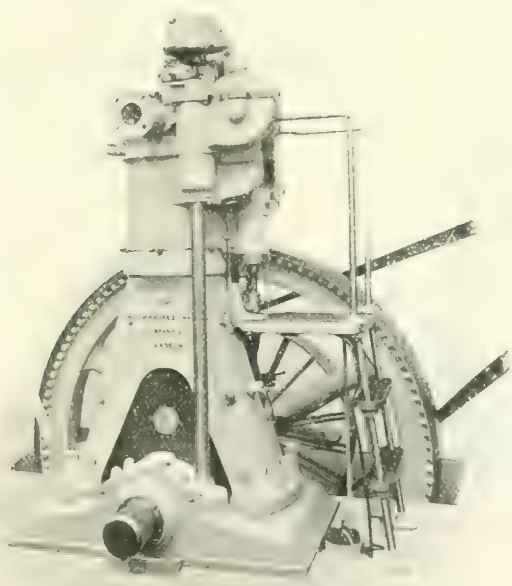

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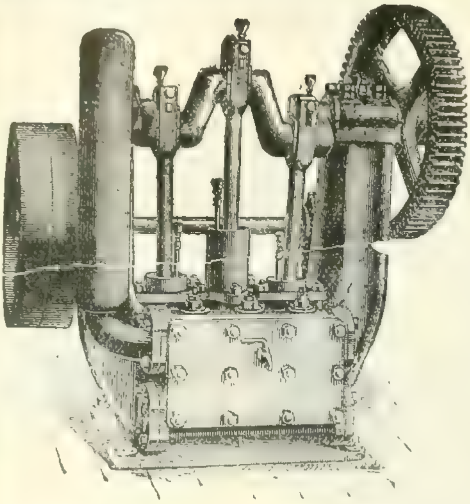

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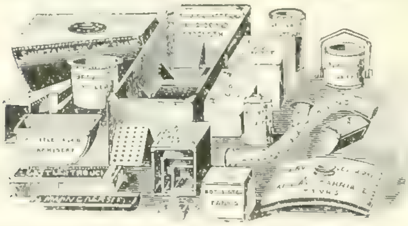

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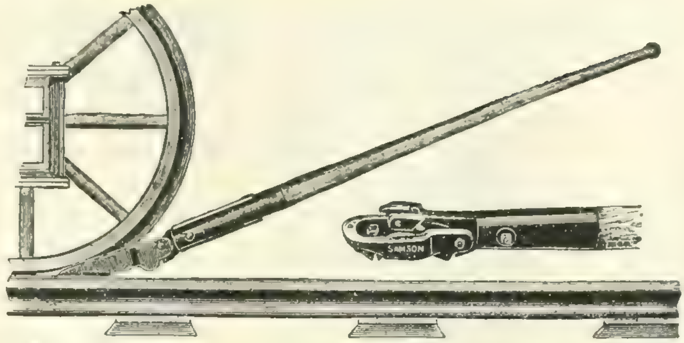

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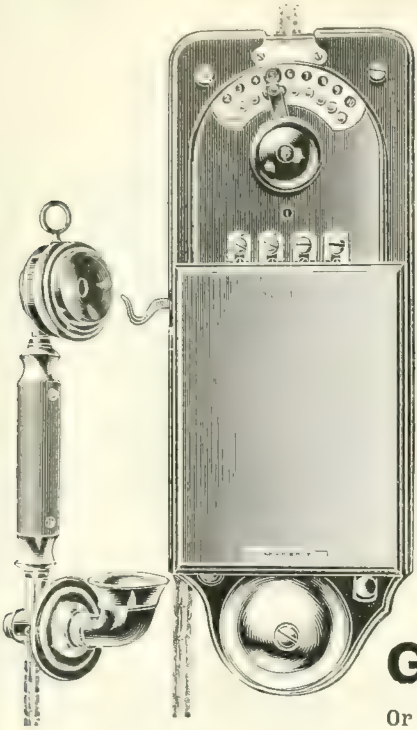

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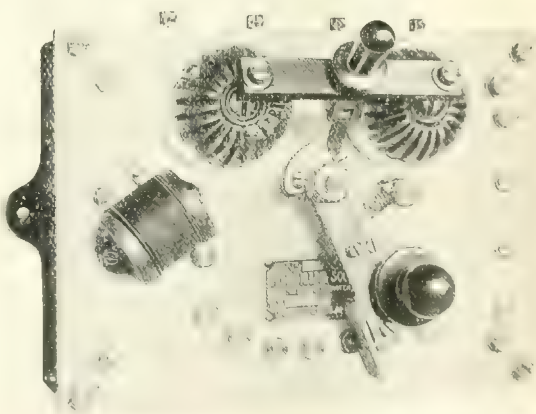

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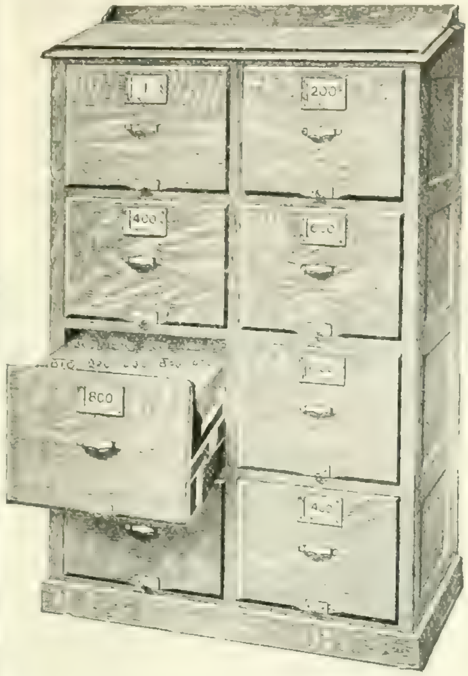

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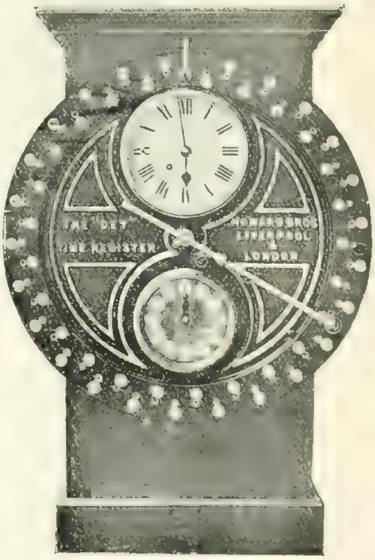

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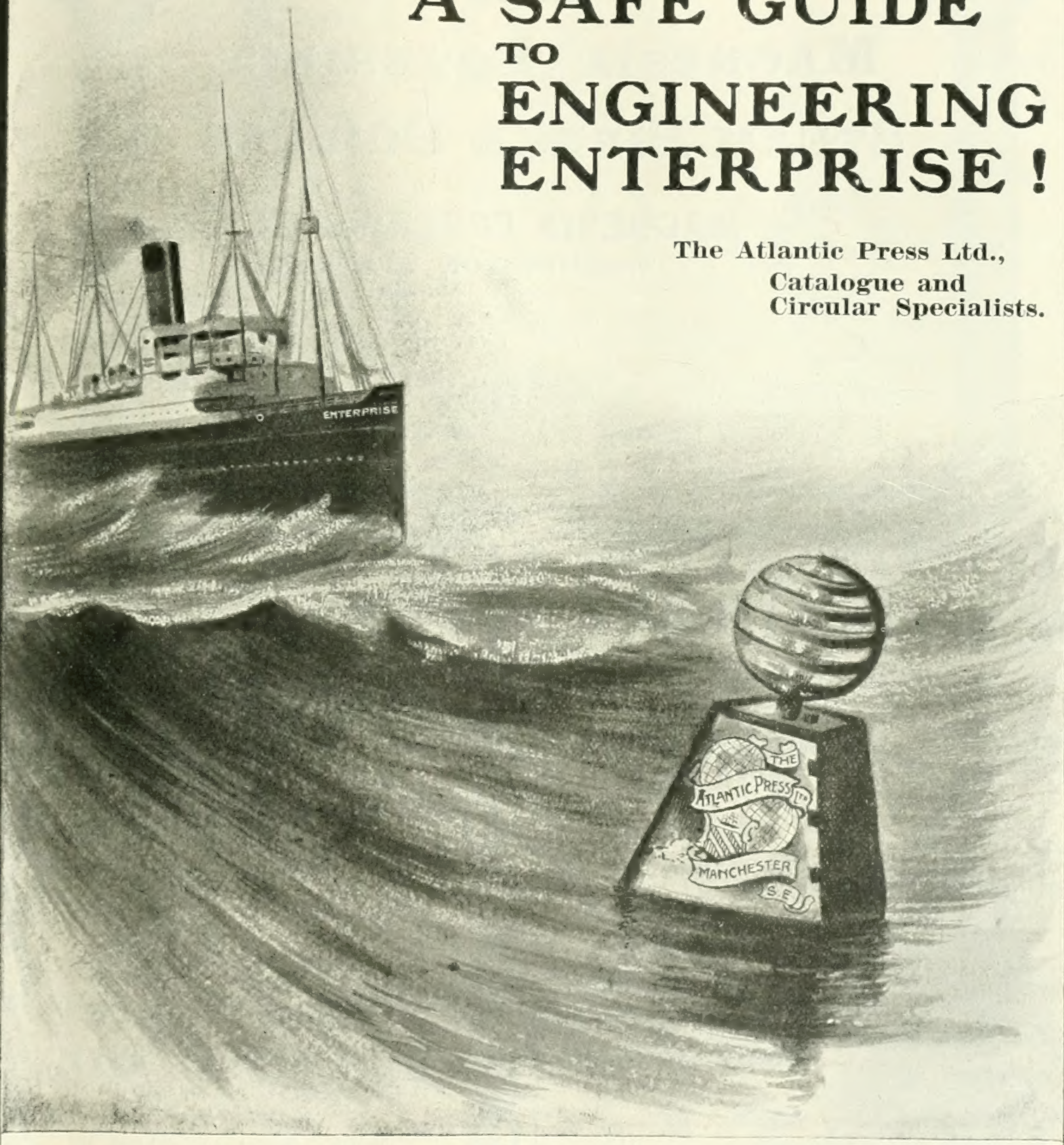

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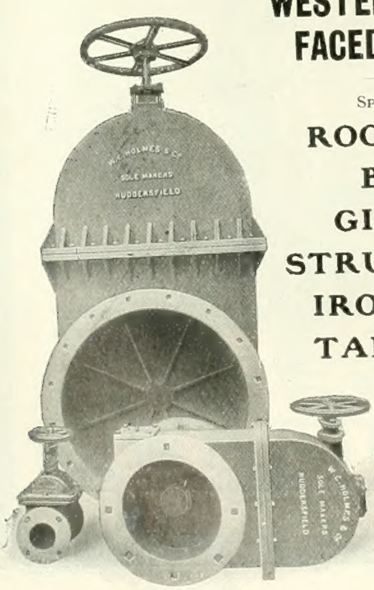

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